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CONFERENCIA DE LAS NACIONES UNIDAS
SOBRE LA APLICACION DE LA CIENCIA Y LA TECNOLOGIA
EN BENEFICIO DE LAS REGIONES MENOS DESARROLLADAS

Punto del programa : D.4

España

LA CONSERVACION DE LOS ALIMENTOS COMO MEDIO DE PRESERVAR EL EXCEDENTE DE PRODUCCION AGROPECUARIA Y DE LA PESCA, PARA LA DISTRIBUCION Y EL CONSUMO DENTRO DEL PAIS, ASI COMO PARA SU POSIBLE EXPORTACION, EN LAS REGIONES O PAISES MENOS DESARROLLADOS

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Las monografías presentadas en la Conferencia de las Naciones Unidas sobre la Aplicación de la Ciencia y la Tecnología en Beneficio de las Regiones Menos Desarrolladas constituyen documentos de trabajo de dicha Conferencia. Se publican tal como han sido presentadas por los colaboradores y los puntos de vista expresados en ellos corresponden a los colaboradores. (Véanse notas al dorso.)

NOTAS

1. Las monografías seleccionadas para las Sesiones Generales serán distribuidas en la Conferencia en los siguientes idiomas oficiales de las Naciones Unidas: español, francés, inglés y ruso.

2. Las monografías seleccionadas para las Sesiones Especiales serán distribuidas en la Conferencia únicamente en uno de los idiomas oficiales antes indicados.

3. Los resúmenes de las monografías presentadas por los colaboradores serán distribuidos en la Conferencia en los siguientes idiomas oficiales de las Naciones Unidas: español, francés, inglés y ruso.

4. No se procederá a la distribución general de las monografías y resúmenes con antelación a la Conferencia. Unicamente serán publicadas en cantidades limitadas con antelación a la Conferencia para uso exclusivo de las delegaciones de los gobiernos participantes y de otros participantes autorizados. La publicación con posterioridad a la Conferencia y la distribución general de las actas y debates de la Conferencia seguirán las prácticas de las Naciones Unidas establecidds por la Junta de Publicaciones de las Naciones Unidas.

La conservación de los alimentos como medio de preservar el excedente de producción agropecuaria y de la pesca, para la distribución y el consumo dentro del país, así como para su posible exportación (en las regiones o países menos desarrollados).

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1. Necesidad de utilizar al máximo las producciones

a) Según recientes datos de la F.A.O., 300 millones de habitantes de nuestro planeta sufren el azote del hambre y 1.500 millones están insuficientemente alimentados. Tal estimación es lo suficientemente expresiva como para evitarnos mayores molestias en el planteamiento de la necesidad de utilizar al máximo las producciones de productos alimentarios.

b) La conservación de estos alimentos, como coadyuvante a tal finalidad, es de tan singular importancia y transcendencia, como pueden ser los programas de incremento y desarrollo de las producciones, ya que a través de dicha conservación no se consigue otra cosa sino aumentar las disponibilidades de productos alimentarios. Recuérdese, a estos efectos, que en países tan desarrollados como Francia las pérdidas por falta de conservación alcanzaban antes de la II Guerra mundial y como media un 10% de la producción y en algunos sectores, tales como el hortofrutícola, tales pérdidas llegaban a absorber un 20%.

c) En este sentido la conservación juega hoy un importante papel, a veces superior al del mero incremento productivo, para cuya consecución se exigen mayores esfuerzos técnicos y económicos.

2. Necesidad de realizar un esfuerzo tendente a elevar el porcentaje de conservación en los países menos desarrollados.

a) De acuerdo con lo que antecede es evidente que una política aconsejable para los países menos desarrollados, es elevar su tasa de conservación. Y ello, no sólo en razón del impacto de la propia conservación "per se" sobre su propio nivel alimenticio, sino también por los efectos inducidos que provocan, indudablemente, sobre las espectativas productoras al crear una demanda adicional.

b) Cabe pués afirmar que la política tendente al incremento de la tasa de conservación de los productos alimenticios ejerce un importante efecto sobre el sector productor, estimulando a éste a una mayor producción. En este sentido dicha política, como no cabía por menos de esperar, es complementaria de la de un desa-

rrollo económico a través de unos incrementos productivos.

c) Por demás, los países menos desarrollados, al igual que los más desarrollados, se mueven dentro del principio de acumulación -aunque con distinto signo en cada uno de ellos- y con arreglo al cual las modificaciones que se producen en el sistema económico general crean fuerzas que empujan al sistema hacia cambios en la misma dirección, en un proceso que no tarda en hacerse cumulativo e irreversible, y nó como pensaban los clásicos, en sentido contrario (1). Este principio, también llamado de causalidad circular cumulativa (2) permite explicar los fenómenos de diferenciación del desarrollo económico entre los diversos países; la formación de los más desarrollados por un lado y la de los menos desarrollados por otro, así como la dificultad para reducir la distancia entre uno y otro. Por él se explica el círculo vicioso de la pobreza (3) y el lugar común de que un país "es pobre porque es pobre", es decir, que la pobreza es la propia causa de la pobreza.

d) Para salir de este círculo vicioso, para escapar del proceso circular y acumulativo, es necesario hacer un gran esfuerzo; es necesario realizar "la arrancada hacia el crecimiento sostenido", según afortunada frase de Rostow (4). Desde este punto de vista la conservación de los productos agrícolas -en especial los alimentarios- es indudablemente un efecto impulsor del desarrollo y complementario de aquél.

3. La conservación de alimentos en un programa de desarrollo económico.

a) Un hecho importante se ha operado en estos últimos tiempos en las políticas económicas de los países, desarrollados o no, cual es el convencimiento de que cada uno de ellos ha de contar con una política nacional de desarrollo económico. Contar con un plan general nacional es hoy la meta de todos los países. Pero todos ellos parten también del supuesto de que es el Estado el que debe contraer la responsabilidad, tanto en la iniciación del plan como en su ejecución (5). A este respecto señala Marrama "que solamente con una intervención pública se puede poner un freno al principio de acumulación que engendra desigualdades entre los países, regiones, sectores económicos, individuos, y de este modo hacer que la acumulación se revele como un instrumento para lograr una mayor igualdad, de suerte que todas las partes interesadas participen en el desarrollo y deriven en beneficio del mismo" (6).

b) No son necesarias ciertamente muchas razones para probar la necesidad de la intervención del Estado en la vida económica de la colectividad a fín de promover el desarrollo económico; a fín de romper el círculo vicioso de la pobreza. Esta intervención ha de ser, sin embargo, programada, de forma que se reduzca el despilfarro de recursos y se consigan los objetivos recorriendo el mínimo camino, es decir, con el mínimo esfuerzo nacional y no siguiendo la llamada curva del perro (7).

c) Esta programación tiene especial importancia en toda econo-

mía y muy concretamente en el sector que nos ocupa, ya que ha de atender a la mayor eficacia en la utilización de los recursos a la vista de las especiales características que los países menos desarrollados presentan. Esta programación ha de tener en cuenta todos los elementos destacados de la situación inicial y prevista de los países, y ha de coordinarlos, estableciendo los objetivos que deben alcanzarse y los medios adecuados para conseguirlos.

d) Partiendo de que los niveles alimentarios en los países menos desarrollados es bastante bajo, se deduce fácilmente que el objetivo de todo programa nacional de desarrollo económico ha de tender, como primera medida, a elevar dicho nivel, bién directa o explícitamente porque así lo fijen los fines, metas u objetivos de dicho programa, bién directamente como consecuencia de que el objetivo sea la elevación de las rentas per capita, lo que implícitamente es lo mismo, ya que siendo la propensión al consumo elevada, todo o casi todo el incremento de renta se dirigirá hacia el sector alimentario.

e) Por otro lado los países menos desarrollados se caracterizan porque su comercio exterior de exportación está signado por el predominio de los productos alimentarios y materias primas. Si a estos efectos partimos del hecho cierto de que el desarrollo de su comercio exterior (en especial la exportación) condiciona el desarrollo económico general del país, llegaremos fácilmente a la conclusión de que la conservación (léase aquí regulación de la exportación) de dichos productos alimentarios es condición básica de dicho desarrollo exterior.

f) La conservación de los productos alimenticios es pués, y en razón de los dos motivos apuntados anteriormente, uno de los fines fundamentales y parte importante de todo programa de desarrollo económico.

4. Factores iniciales del Programa de Conservación.

Para la elaboración de un Programa de Conservación de los productos alimentarios hay que considerar los siguientes factores iniciales:

a) Factores que afectan a la población

i) No solo la población existente en el momento de redactarse el programa, sino sus tendencias. Estas últimas deberán imprimir, según el crecimiento esperado, positivo o negativo, un ritmo más o menos acelerado al programa.

ii) También habrán de tenerse en cuenta los factores subjetivos que podemos englobar en la denominación "gusto del consumidor", de difícil apreciación.

iii) Deberán observarse no solo los movimientos demográficos, en especial el posible éxodo rural, sino también la distribución de la población en núcleos urbanos y rurales. Este último aspecto es de singular importancia no ya en cuanto a los distintos niveles alimenticios sino también en cuanto a su composición. Este punto se desarrollará posteriormente.

iiii) El estudio de la composición de esta población por edades y sexo es también de interés.

b) Factores que afectan a los niveles de renta

i) Siendo los niveles alimenticios función, hasta un cierto punto, de los niveles de renta o ingreso, pudiéndose afirmar por demás, que la mala o inadecuada distribución de la renta es patrimonio de los países menos desarrollados, de forma que a menos desarrollo, peor distribución, es necesario de todo punto estudiar la distribución de la renta nacional por grupos de población.

ii) Si el sistema estadístico captador de datos está lo suficientemente desarrollado -cosa poco probable- hay que estudiar las desiguales repercusiones que ha de tener sobre dicha distribución una tasa de crecimiento de la renta nacional, fijada por el Programa Nacional.

c) Factores que afectan a los niveles de consumo

i) La determinación de los niveles de consumo "per capita" iniciales, es de todo punto imprescindible para la elaboración de un Programa de Conservación.

ii) Si el sistema estadístico captador es apto para ello, es de gran interés conocer las elasticidades de consumo en relación con el gasto. En caso de no ser posible pueden seguirse dos métodos; efectuar una breve encuesta por muestreo o bien aplicar con las debidas reservas las elasticidades de países similares en cuanto a su renta per capita y zona geográfica (8).

iii) Particular interés presenta la determinación de los distintos niveles alimenticios de la población rural y de la urbana. En países marítimos en los que la red de transporte no esté muy desarrollada cabe distinguir también la zona costera de la interior. En todas ellas se estudiará la composición de dichos niveles, sus analogías y diferencias, ya que ello ha de influir notablemente sobre el programa de conservación.

A estos efectos, cabe señalar que, por ejemplo en España, la composición porcentual del consumo carne es exactamente la inversa para la procedente del vacuno y cerda:

- Consumo porcentual -

Zona	Vacuno	Cerda
Urbana	75	25
Rural	25	75

d) Factores que afectan a los niveles productivos

i) La consideración y estudio de todos aquellos productos alimentarios más o menos perecederos y susceptibles de ser conservados, es de todo punto imprescindible.

ii) Dentro del anterior estudio y en estrecha relación con él habrán de evaluarse no solo las actuales producciones, sino también sus tendencias, a ser posible por zonas productoras.

iii) Especial interés ofrecen, a estos efectos, las zonas de cultivo intensivo y en concreto las superficies regables.

iiii) En este sentido el conocimiento detallado de los planes de futuras puestas en regadío es fundamental.

iiiii) Particular interés ofrecen los datos relativos a los calendarios productivos por zonas y productos.

e) Factores que afectan a las corrientes comerciales

i) Las corrientes de tráfico de los productos alimentarios han de ser objeto de estudio en todo Programa de Conservación.

ii) Especial interés han de ofrecer las corrientes exteriores de tan vital importancia en todo Programa de Desarrollo.

f) Factores que afectan a los productos y a las economías externas

i) Un estudio de las distintas variedades dentro de cada producto y de sus características es fundamental para la determinación de los sistemas de conservación más aptos.

ii) Dentro de esta línea han de considerarse también los sistemas tradicionales de comercialización en cada país, que, a efectos de las economías externas y técnica, puede ofrecer cierto interés su desarrollo.

5. Características de la Red de Conservación

a) Técnicas a emplear

1) Consideramos que en un país de bajo desarrollo, no existiendo redes organizadas de conservación y dada la diversidad de métodos técnicos, será frecuente que caracterice los eslabones de la Red, la acumulación de diferentes técnicas en un eslabón.

Así, cada uno de ellos contará con medios frigoríficos, de appertización, deshidratación, etc., no solo para aplicar cada uno a productos diferentes, sino para que dentro de un mismo alimento se aplique cada sistema según calidades y estado, (refrigeración a las primicias del producto, appertización y congelación a producciones masivas, deshidratación y appertización a destrios, etc.).

ii) Creemos por tanto que al efectuar el programa de conservación, cada eslabón de la Red, acumulará medios para aplicar diferentes clases de conservación.

Con ello, el aprovechamiento de los alimentos será completo, pués si determinado eslabón no contase más que con una técnica de conservación, frio, por ejemplo, la producción recogida que no fuera muy apta para este tratamiento y sí para otro, appertización o deshidratación, se perdería o tendría que ser transportada, con mermas y aumento de gastos a otro eslabón que tuviese medios aptos para su calidad y estado.

iii) La característica antes apuntada, de acumulación de varios métodos de conservación en un mismo eslabón de la Red, pueden brindar ocasión de adaptación de los sistemas clásicos industriales a esta característica.

Así la conveniencia de contar en una misma planta industrial con frio y calor, para la conservación de alimentos, pueden aconsejar en determinados casos, que el sistema de compresión para producir frío, sea sustituido con economía por el de absorción.

iiii) También la posibilidad de contar con frio en una planta que va a deshidratar alimentos, puede en algún caso permitir que económicamente, se aplique este frio a la desecación, para la liofilización o concentración de determinados productos.

b) El problema de la energía

i) El incremento que está experimentando, el estudio científico sobre producción de energía fuera de los procedimientos clásicos, puede permitir, si económicamente es aconsejable, aplicar a los eslabones de la Red, algún moderno método. Por ejemplo, la energía eólica podrá aplicarse en determinadas zonas y acaso el empleo de energía solar pueda ser pronto tenido en cuenta, para determinados eslabones de una red en zona determinada. En eslabones que hayan de instalarse en la costa, la energía de las mareas puede alguna vez ser utilizada. Otro tanto cabe señalar sobre la posible aplicación de la energía atómica, condicionada a la posible adquisición de centrales y reactores en países desarrollados.

ii) Sin embargo, consideramos que la energía a emplear ha de ser la clásica, ya que en mucho tiempo estas otras, no estarán económicamente al alcance de instalaciones industriales.

6. Previsiones del Programa de Conservación

a) Determinado en el Programa General Nacional la tasa de crecimiento de la renta y su repercusión en los diferentes grupos de población, se hará una proyección de las demandas de productos alimentarios para un plazo determinado (5 o 10 años) teniendo en cuenta el crecimiento vegetativo de la población y el desarrollo demográfico. Para esta proyección de la demanda habrá de tenerse en cuenta:

i) La propensión al consumo y en todo caso las elasticidades del consumo.

ii) La tendencia a mejorar las dietas alimenticias (decremento de hidratos de carbono y de grasas; incremento de proteínas y de aquellos alimentos ricos en vitaminas y sales minerales).

iii) Las exigencias de los mercados exteriores.

b) Evolución de las producciones.- En estrecho contacto con el Programa General y coordinándolo con él habrán de estudiarse las zonas productoras, tanto las tradicionales, como las que a través de nuevas roturaciones o puesta en riego puedan crearse. De su comparación con la proyección de la demanda surgirán no solo el Programa de Importaciones (en caso de déficits) o el de Exportaciones (caso de excedentes), sino también el Programa de Abastecimientos Nacional.

c) Red de Conservación

i) A la vista de los anteriores resultados ha de elaborarse la

Red de Conservación. En ella han de seguirse varios criterios basados todos tanto en los costes de entrega y de reunión de los productos (economía de transporte) como en las particulares características de cada producto alimentario, en especial su mayor o menor fragilidad y su mayor o menor grado de conservabilidad. Ciertas normas sanitarias deberán también ser tenidas en cuenta para que el producto llegue a los consumidores en el mejor estado posible.

ii) En líneas generales pueden señalarse los siguientes principios locacionales:

a - Todo producto masivo debe ser tratado y conservado en zona de producción.

b - La anterior consideración debe extenderse también y con mayor motivo a todos aquellos productos alimentarios que en su proceso de acercamiento al consumo sufran una pérdida sustanciosa en peso, compensadora de una mayor economía de transporte.

c - Idéntica consideración debe ser la orientadora para todos aquellos productos que requieran un tratamiento específico inmediato para su mejor conservación, tras su recolección o producción.

d - Para los productos de importación la red de conservación debe ser establecida en centros consumidores y puntos de entrada.

e - Para los productos de exportación la Red debe basarse en zonas de producción y en puntos de salida, en especial puertos, donde se formarán las unidades comerciales mínimas.

iii) Cabe afirmar pués que la Red de Conservación y sus eslabones han de estar localizados en función de una economía de volúmen y de transporte. No obstante lo anteriormente señalado, los distintos métodos o procedimientos de conservación imponen sus criterios, bién en razón de su técnica, bién en razón de las propias exigencias de la función comercializadora que desarrollan, o finalmente, de las normas sanitarias que cada país posea o exija.

iiii) Otro tanto puede señalarse en razón de factores tan complejos como las líneas de comunicaciones, posibilidades de energía, posibilidades de combustible, e, incluso clima, todos ellos determinantes de la localización de las actividades económicas.

d) Programación de necesidades e inversiones

i) Establecidas las localizaciones de acuerdo con las líneas directoras antes apuntadas, que deberán ser objeto de estudio específico en cada caso y de forma general por sectores productivos, es de interés elaborar un programa de necesidades y de inversiones. Este programa de necesidades deberá ir desarrollado en el tiempo, por lo que las instalaciones deberán ser susceptibles de ampliación futura, no solo en razón de los esperados incrementos de producción (instalaciones en zona de producción) sino también en función del incremento de población (instalaciones en centros de consumo) y, fundamen-

talmente, de los esperados incrementos de renta derivados del Programa General de Desarrollo.

ii) Dado lo complejo del problema, la capacidad de las instalaciones deberá ser objeto de estudio particular y específico, no obstante lo cual puede establecerse el programa general de inversiones a realizar para cumplir con las etapas que se prevean en el desarrollo.

iii) El criterio de prioridad debe ser marcado, salvo factores de índole político o de defensa, por la rentabilidad de la inversión. Con independencia de lo que se deduzca de cada estudio particular, un criterio puede ser la relación capital-producto, aunque hay que señalar que en este tipo de actividad es generalmente baja.

7. Funciones de la Red de Conservación.

a) El fin primordial, ya enunciado, es el de preservar los excedentes, bien permanentes o transitorios, de los productos agropecuarios y de la pesca. Las diferentes formas que puede adaptar la Red de Conservación, tienden todas ellas no solo a evitar unas pérdidas, sino también, y fundamentalmente, a atenuar la oposición entre la producción estacional (característica de las producciones agrícolas) y el consumo permanente. Esto último es el fin fundamental de toda Red de Conservación.

b) Funciones subsidiarias son, entre otras, (9):

i) Mejorar en calidad la alimentación.

ii) Regularizar los mercados, ampliando el período de conservación.

iii) Revalorizar los productos evitando caidas peligrosas de precios.

iiii) Estabilizar en lo posible los precios de consumo a través de una más regular oferta.

iiiii) Reducir las pérdidas causadas por los transportes.

8. La Red de Conservación por frío en España.

a) La redacción del Plan de Red Frigorífica Nacional, factor fundamental de la Red de Conservación, fué encargado por el Gobierno español al Instituto Nacional de Industria en 1.948. Después de detenidos estudios fué aprobado por el Gobierno y encargado de su desarrollo al propio Instituto.

b) Debido a las anormales circunstancias económicas por las que atravesaba España por aquellas fechas, todavía no recuperada de su guerra civil y de las repercusiones de la segunda guerra mundial y ante la ausencia de un plan general de desarrollo, el Plan de Red Frigorífica español no tiene otro carácter que el de una mera enumeración de necesidades frigoríficas a corto plazo. Estas se evalúan por diferencia entre las disponibilidades regionales y los consumos locales y de mercados próximos, fijándose por demás las localizaciones más aconsejables de las instalaciones, así como su volúmen.

c) El fín del Plan de Red no es sino dotar a la población española de una capacidad frigorífica de 25 m3. por cada 1.000 habitantes, distribuidos en frigoríficos de zonas productoras, co-

merciales, de consumo, así como otras instalaciones complementarias. Esta meta, según ha puesto de manifiesto el Primer Censo de la Industria Frigorífica española, realizado a finales de 1.960, por el propio Instituto, ha sido lograda en dicho año.(10)

d) El Instituto ha colaborado a ello creando tres magníficas instalaciones frigoríficas, dos de ellas las mayores de España, al presente, y prestando asistencia técnica a una veintena de grandes frigoríficos distribuidos por el territorio nacional.

e) Actualmente nuestro país elabora su primer Plan de Desarrollo General. Dentro de él la industria frigorífica ocupa un importante papel como colaboradora en el desarrollo agrario. A tal fin, por el Instituto Nacional de Industria se ha elaborado un estudio sobre las normales y grandes corrientes de tráfico de productos perecederos con proyecciones que alcanzan a 1.979. Tal investigación ha de ser, sin duda, utilizada para el desarrollo del sector frigorífico, tanto en su aspecto fijo como móvil, en un programa a plazo medio y largo.

Madrid, Agosto 1.962.

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UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

SUMMARY

Agenda Item: D.4

Spain

FOOD PRESERVATION AS A MEANS OF UTILISING SURPLUS AGRICULTURAL AND FISHERIES PRODUCTION FOR INTERNAL DISTRIBUTION AND CONSUMPTION AND FOR EXPORT : TO LESS DEVELOPED REGIONS OR COUNTRIES

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Papers have been contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas as working papers for that Conference. They are published as presented by the contributors, and the contents and the views expressed are those of the contributors. (See notes overleaf.)

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FOOD PRESERVATION AS A MEANS OF UTILISING SURPLUS AGRICULTURAL AND FISHERIES PRODUCTION FOR INTERNAL DISTRIBUTION AND CONSUMPTION AND FOR EXPORT (TO LESS DEVELOPED REGIONS OR COUNTRIES)

By

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SUMMARY

It is advisable for all countries to raise their volume of preservation of foodstuffs, not only because of the effects directly resulting from such an increase but also on account of induced results which may be brought about by creating an additional demand upon the producing sector, thus stimulating increased production. This policy should be embodied in a general development programme, however, so that it may become part of what Rostow calls "the starting-point of sustained growth", which goes beyond the principle of stocking and is a factor in breaking the vicious circle of poverty, a feature of the less developed countries.

2. State intervention in economic life, through a programme of economic development, is today a proved need. In this programme the plans for a refrigeration network have an important part to play, since the aim of such planning cannot be other than that of increasing diet levels both directly (or explicitly) and indirectly (or implicitly, through an increase in revenue) owing to these countries being highly prone to food consumption; in addition they normally enjoy a substantial export trade in foodstuffs and raw materials, for which reason alone a refrigeration network is particularly interesting.

3. Planning in this important field should take into account all the outstanding factors of the initial position and its medium and long-term provisions by co-ordinating them and specifying the aims to be attained and suitable means of achieving them. In the not strictly economic sphere

special importance must be attached to techniques -several of which can and should be used in one and the same link of the network - as well as to the question of energy in the light of the expansion which is taking place in the scientific study of new sources of production.

4. The refrigeration network should be directed not only to lessening opposition between seasonal production (a characteristic of agricultural output) and consumption (of a permanent nature) - a fundamental purpose - but also to improving the quality of foodstuffs, regularising markets by extending preservation periods, stablising prices to consumers by providing a more regular supply and reducing transport losses.

5. A brief report is included on the character of the Spanish refrigeration network and the methods employed in organising it.

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FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

Agenda Item: D.1

United States of America

THE PROVISION OF ADEQUATE CAPITAL FOR INDUSTRIALIZATION

By Alfred C. NEAL,
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No. 732 THE PROVISION OF ADEQUATE CAPITAL FOR INDUSTRIALIZATION
D.1

by
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New York, N. Y.

1) There are few truths in social science more demonstrable than the necessity of capital for economic development, and of a growing rate of capital investment -- in people as well as in tangible form -- for increasing living standards. What is true for economic development is even more true for industrialization, which is synonymous with the use of machinery and of technological and managerial skills to multiply the power to produce goods.

2) There are few facts more evident in the less developed parts of the world than the inadequacy of capital for most of the needs of industrialization. This despite the fact that in the industrialized nations enormous quantities of capital funds are seeking investment and, in the face of very moderate rates of return, are being invested mainly within the industrialized nations. (See Table 1 showing the distribution of U. S. direct investments abroad.) The contrast poses questions which must be considered in a paper of this kind, because in the explanation of the contrast some of the most important questions may be answered.

The Role of Other Factors in Industrialization

3) The essential nature of capital is that it yields its product over a period of time -- often over a decade or more, as depreciation schedules readily demonstrate. Some of the basic investments facilitating industrialization, such as power and transportation systems, have the longest useful lives and therefore the longest pay out periods. Therefore, a major consideration in investment -- the conversion of liquid capital into produced means of further production -- is not only the current rate of return on investment, which may be very high in less developed countries, but the degree of uncertainty over the realization of these returns over the useful life of the investment. A high degree of uncertainty means that a high discount must be applied to the returns of future years, and that therefore the present value of these returns may be very low. There is no paradox in the fact that most investment is concentrated in developed countries with current rates of return less than those in less developed countries; the discount for risk and uncertainty accounts for most of the difference. This phenomenon is a consequence of rational calculation, not necessarily of differences between economic systems.

4) My first conclusion is, therefore, that provision of adequate capital for industrialization depends upon reasonable stability in those conditions which affect the prospective rate of return on capital. The foremost of these conditions are political stability and good government administration. These conditions will permit capital to be used effectively, without interruptions, delays and vexations which so seriously impair productivity, and without drastic and uneconomic changes in laws and regulations affecting the use of the investment or the distribution of

its products. Many of the less developed countries cannot now assure these conditions.

5) For foreign capital investment in less developed countries, the stability conditions have additional content. The prospective return on investment is dependent not only upon domestic stability in the recipient country but also upon stability of their exchange rates, inasmuch as the foreign capital must be repaid in currency equal to that originally invested. The measure of equality is usually a fixed rate of exchange with a strong currency.

6) In addition to these general conditions, usually called "the investment climate" in English, there are other indispensable conditions with respect to the supply and quality of the other factors which must be directly combined with capital to produce industrial goods. Of these, the most important is management, especially because management can overcome deficiencies in other factors. Management is the function of initiating, directing and coordinating all of the factors to produce industrial goods with reasonable economy and efficiency. A superabundant supply of capital, such as that already available to several less developed countries, can contribute little to industrialization if management is deficient in numbers having the necessary skills. Ability to exercise the management function successfully is not acquired only by education, but also requires experience. It seems also to require special qualities of mind and personality which neither education nor experience are able to provide. The scarcity of good management is not limited to the less developed countries; it is cited in the developed countries most frequently as the factor in constantly short supply. It is the judgment of many of those responsible for international lending that inadequacy of management in less developed countries is a more important obstacle to progress than inadequacy of capital.

7) Finally, for successful use of capital in industrialization there must be an adequate supply of workers well enough educated, trained and motivated to perform the tasks assigned to them. This requirement is not uniform for all workers but varies with their jobs and the industries in which they work. In the developed countries, the minimum educational attainment for industrial workers has become ten to twelve years of schooling, but it is not clear that so much education is actually required for most jobs. Most of the industries now being carried on in less developed countries do not require such educational attainment, and much expansion of industry is possible on a minimum educational program.

8) It is not enough, however, to assure sufficient education and training for an industrial labor force. Productivity depends upon rates of pay between jobs and persons being equitable, and on a level of pay which bears a reasonable relationship to the level of productivity in the country. Improvements in productivity should be equitably shared with workers in ways which both promote their improved performance and make them better customers. Only by gearing increases in pay to increased productivity can living standards be raised and motivation for improved productivity encouraged. Moreover, health and housing have a direct bearing on productivity, and are a legitimate concern of good management and good government in countries seeking to industrialize.

9) The foregoing briefly indicates the role of factors other than capital in industrialization. Another requirement, adequate markets to achieve minimum economies of scale, will be discussed later. Capital, management, labor and markets are as essential to successful industrialization as four legs to a horse.

And, just as a horse may require a road to run with any speed, stable and efficient government providing a good investment climate is required if industrialization is to progress with reasonable speed.

Lessons from the Developed Countries in Meeting Gaps in the Supply of Capital

10) As noted before, capital in liquid form is essentially present purchasing power which is exchanged for a promise of future repayment out of the proceeds of productive investment. The developed countries have evolved institutions and methods for mobilizing large amounts of such capital, and for channeling it into industrial investment.

11) Capital for industrialization consists essentially of three types: (1) short-term loans for financing current operations, inventories, and accounts receivable; (2) intermediate and long-term loans (over ten years) for financing plant and equipment; and (3) equity capital, the permanent capital supporting the whole enterprise which also provides a margin of security for all types of loans. Not included in these categories is the capital for supporting infrastructure for industrialization -- roads and other means of transport, harbors, docks, public storage facilities, communications, etc. -- which require financing of a permanent type, often by governments.

12) In the advanced countries and the developing countries alike, short-term capital -- under six months' financing -- is generally available, and for well-established enterprises there is little difficulty in securing financing up to one year when it is needed as an integral part of an operation. This is the traditional field of commercial banks which obtain their funds from deposits, usually payable on demand, of businesses, governments and individuals. The most important gap in short-term financing is for poor credit risks, and these are assisted by a variety of specialized institutions, including government financed institutions like the Small Business Administration in the United States.

13) Intermediate and long-term financing for industry in developed countries is similarly available through a variety of channels. For well-established companies needing longer-term financing in quantity, the predominant source of funds is the retained earnings of the enterprise itself. This source, which increases the proportion of equity capital in the enterprise, is a major substitute for loans. To augment this source, the capital market (for bonds), insurance companies, pension and trust funds, and banks with term and savings deposits, or, in Europe, banks specializing in industrial financing, are all available. These sources of long-term credit are not well established in developing countries, partly because incomes are so low. Even where they are established, their investment policies may be heavily conditioned by instabilities in government and in monetary conditions in ways which discourage their financing of industry.

14) Equity financing in capitalist countries is supplied mainly by capital markets, supplemented especially in Europe by banks which specialize in such financing. Smaller amounts are usually supplied by the owners and those personally known to them; larger amounts are raised by public offerings in the market through investment bankers who specialize in the sale of longer-term debt and equity securities.

15) These various channels and institutions have been sketched briefly to indicate the types of financing required for industrial firms and to provide background for what follows. In the advanced countries capital needs have

been so well supplied that careful studies and experiments have been necessary to ascertain the gaps and to find means of filling them. The gaps have been found to be in financing for terms of more than five years and for amounts, in the United States at least, of under about $300,000. These gaps are usually found among new and rapidly growing enterprises, which have difficulty in securing enough equity capital (the usual description being that they are "under financed") and in securing loans for purchase of equipment and expansion of plant. This finding is particularly relevant for less developed countries, where new, smaller and, hopefully, rapidly growing enterprises are likely to be numerous in the early stages of industrialization.

16) New and specialized institutions have been established in the developed countries to fill these gaps. In the United States, Canada, England and some other countries, a national institution has been established with government or official financing. In the United States, in addition to a national publicly financed institution, both private and state financed institutions have also been established (e.g., equity capital corporations or groups, development credit corporations, small business investment companies, state development corporations, etc.). Hundreds of local areas have also set up privately financed corporations to supply industrial plants or long-term loans for new plants to stimulate industrial growth in the local area which they serve.

17) Developing countries are characterized by both an inadequate supply of savings and inadequate channels for financing industry with the savings available. Because industrialization can raise income levels upon which an increased supply of savings depends, special attention to the problem of improving channels for moving savings into industry is especially important.

18) Developing countries usually lack adequate institutions for providing either equity capital or longer-term loans to industry. Because the smaller and rapidly growing industrial firm is likely to predominate in such countries, and because such firms may be expected to encounter the most serious capital shortages, special attention to this type of financing is called for. Large scale, foreign financed and managed industrial companies can draw upon their own resources and those of the capital markets in developed countries, but smaller firms cannot. What is very much required in the developing country, therefore, is a substitute for the capital market and its institutions, a substitute that performs the same economic functions. Moreover, such a substitute should, so far as possible, be a channel linking the capital markets of developed countries and the capital supply of international agencies to the capital needs of developing countries.

19) A type of institution to meet this range of financing needs is comparable to the special institutions which have been successfully pioneered already to fill the gaps in longer-term and equity financing in the developed countries. It is usually called a development bank. Fortunately, there is in this collection of papers a special paper on development banks, and the reader is referred to that paper for an adequate treatment. (See Vincent Checchi, "Development Banks".)

Domestic vs. Foreign Sources of Capital

20) The essence of capital from the supply side is the transfer of resources from producing goods destined directly for consumption to producing goods which are destined to make other goods, e.g., from growing food to making a plow. This transfer of resources is nowhere more evident than in the less developed

countries where resources are devoted primarily to producing a minimum supply of goods for consumption. To secure industrial development, it is necessary to devote a larger proportion of resources to investment. This means to reduce an already low level of consumption, to skim off into new investment as much of any increase in productivity as possible, or to increase total effort, or to do some combination of all three.

21) The bulk of an increase in capital formation represents a transfer of domestic resources into capital formation. Lengthening the period of education or increasing the numbers in school is a domestic transfer. Building a road represents another such transfer, as does the construction of houses. If such activities were financed by foreign loans, their essential nature would not change; the loan would pay for the real resources which were transferred, but no addition to domestic resources would be made available by the foreign financing. If the loan were used to pay for increased imports to replace goods formerly made by the resources being used to carry out the investment program, then the loan would add to the total resources available, but it would impose a requirement to repay in exports (or in reduced imports) for investments not necessarily related to the production of export goods or import substitution goods. The essential point is that the possibilities of using foreign capital are limited by the capacity to generate foreign exchange, and that to use foreign capital for investments not related to such a purpose invites default on foreign obligations and the consequent drying up of the foreign sources of supply.

22) Recent estimates 1/ of net investment that might be made productively in the less developed world indicate that about 75 percent of the net investment can be financed from domestic savings and about 25 percent may be needed from foreign sources. In the case of the twenty Latin American countries participating in the Alliance for Progress, the investment program for 1962-71 calls for about 85 percent of the investment to be domestically financed and 15 percent to be financed from foreign sources. These figures, while illustrative, indicate that domestic, not foreign, sources are expected to supply the major part of the capital required for development.

23) Economic utilization of capital for industrialization calls for a careful plan which relates domestic sources of capital to essentially domestic projects and foreign sources of capital to investment goods obtainable only from abroad. It also calls for planning foreign exchange earnings sufficient to service and discharge foreign loans. The almost universal restriction of foreign payments in developing countries attests to the insufficiency of prior planning in these respects. Much of the foreign capital from governments and international institutions has had to be used for meeting foreign exchange deficiencies rather than for new investment in equipment of the types available only from foreign sources.

24) Experience to date argues strongly for industrialization that clearly meets two requirements: (1) It uses capital most efficiently, which is best measured by projects yielding the highest discounted return over cost and (2) it fits into a total development program which will adequately meet the payments in foreign exchange entailed in its financing. These requirements can be met by a carefully planned program or by leaving to free markets the problem of allocating and directing capital. There is still great uncertainty about the

1/ Paul N. Rosenstein-Rodan, "International Aid for Underdeveloped Areas," The Review of Economics and Statistics (May 1961), 107-138.

capacity of less developed countries to follow the former course, and there is great reluctance in most of the less developed countries to follow the latter.

Economies of Scale and the Problem of Markets

25) The selection of industries to establish or to expand in a developing country, assuming some purposive governmental direction of the process, is complicated by the constraints imposed by technology. Virtually any product can be made in a developing country if cost and efficient use of capital and foreign exchange resources were not considered. Because both capital and foreign exchange are scarce, economic use of both argues for the establishment of plants as nearly competitive with those elsewhere as possible.

26) There is a wide range of products that can be made in smaller plants serving limited markets. (A paper in this collection by Eugene Staley on "The Role of Small and Medium Industry in Industrial and Economic Development" explores this field.) A recent study for the United States International Cooperation Administration demonstrates that profitability of manufacturing in many lines is average or above average in smaller plants in developing countries. The list with above average profits includes soft drinks, distilled and malt beverages, ice, rubber products, pharmaceuticals, paper and paper products, printing and publishing, structural clay products, concrete products, certain types of electrical machinery and appliances. The list of lines showing average profitability is similarly extensive: sugar refining, cotton, wool and knitted textiles, as well as textile finishing and dyeing, furniture, certain metal products, glass and glass products, machine shops. Neither list is exhaustive.

27) At the other end of the scale, certain manufactures are likely to be carried on only with very large investments and primarily for export. Examples are aluminum and copper. There are resource-oriented industries likely to be undertaken only with extensive foreign capital, management and marketing assistance.

28) There is a wide range of other manufactured products which, to support optimum size plants, require markets far larger than those available in one developing country or even a contiguous group of them. If we use the scale of United States plants as a standard for optimum size, a market with United States purchasing power per capita of eleven million people would be required for one automobile plant making its own engines and bodies, but not other components, and an investment of $250,000,000 to $500,000,000 2/. The market of a developing country would have to be roughly ten times as big, or of more than 100,000,000 people to justify one such plant.

29) Other examples are steel, with a capital requirement of $300,000,000 to $700,000,000 and a developing country market of more than 26,000,000 people; petroleum refining, with capital requirements of $225,000,000 to $250,000,000 and a market of 26,000,000 or more; rayon, with capital of $50,000,000 to $75,000,000 and a market of 75,000,000; tires and tubes, with capital of $15,000,000 to $30,000,000 and a market of 31,000,000. The fact that such plants exist in some countries with smaller markets than these indicates that costs are not competitive, which is usually the case, or that the domestic market is supplemented by the foreign market.

30) It must be concluded that the economies of scale require plants of such large size for many products that developing countries would have to form customs unions to justify their establishment if they wish to produce reasonably low-cost products. In these cases, nationalism is the enemy of efficiency.

2/ This and the following examples were derived from Bain, Joe S., Barriers to New Competition, Harvard University Press, 1956.

31) Differences in the sources of capital available for various types of projects may well result in the neglect of highly productive and profitable smaller industrial plants and emphasis upon large, high capital cost projects in industry and in other fields. Typically, the rate of interest from domestic sources in less developed countries for financing small undertakings is very high, often from 10 to 25 percent or more. On the other hand, loans from international agencies or foreign government sources for large projects, or the rate on borrowings in their home countries by corporations establishing plants in developing countries, may be six percent or less. Projects which are economically justified in the eyes of the foreign lender or investor may contribute far less to the productivity of the developing country, per unit of capital investment, than would equivalent investments in a number of small manufacturing plants able to earn the going rate of return in the developing country.

32) To secure optimum size plants which will be competitive with foreign sources of supply, and to secure maximum returns from the limited supply of capital available to them, most developing countries would be well advised to establish development financing institutions which concentrate upon smaller plants capable of earning the high domestic rate of return on capital, particularly when foreign capital to finance such development financing institutions is available at relatively low cost. As Table 2 indicates, the volume of aid available for such purposes may be very large, but little of it has so far been channeled through such development financing institutions into smaller plants.

33) The considerations discussed in this paper seem to demonstrate that adequacy of capital for industrialization cannot be determined by statistical measures relating volume of investment to gross national product or income, or by relating the volume of foreign capital available or used to some measure of need. Conditions largely within the control of the developing countries would appear to determine whether larger supplies of capital can be made available and can be effectively used.

Table 1 -- Cumulative book value of U. S. direct investments abroad by geographical areas, 1946, 1950, 1955, 1957, 1959, and 1960

(Billions of dollars)

	1946	1950	1955	1957	1959	1960 a/
World total	$7.2	$11.8	$19.3	$25.3	$29.8	$32.7
Canada	2.5	3.6	6.5	8.6	10.3	11.2
Europe b/	1.0	1.7	3.0	4.2	5.3	6.6
Oceania, Japan, and Union of South Africa	.2	.4	.9	1.2	1.4	1.5
Total, high investment countries	3.7	5.7	10.4	14.0	17.0	19.3
Latin America c/	3.0	4.6	6.4	8.1	8.9	9.3
Middle East d/	.2	.7	1.0	1.1	1.2	1.2
Asia e/	.2	.3	.5	.7	.8	.9
Africa f/	.1	.15	.3	.4	.5	.6
Total, low investment countries	3.5	5.8	8.2	10.3	11.4	12.0
International g/	h/	.35	.6	1.0	1.4	1.4

a/ Preliminary.

b/ Includes Turkey.

c/ Includes 20 Latin American Republics and dependencies.

d/ Includes countries East of Suez up to and including Iran but excluding Turkey.

e/ Excluding Japan.

f/ All of Africa except Union of South Africa.

g/ Shipping enterprises registered in Liberia and Panama but operating worldwide.

h/ Not available.

Source: U. S. Department of Commerce, "Survey of Current Business," various issues.

Table 2 -- GNP and commitments of loans and grants for selected countries to less developed areas, 1960

(Millions of U. S. dollars)

Country	GNP at current prices (estimated)	Commitments			Total commitments as per cent of GNP
		Loans over 5 years	Grants	Total loans and grants	
U.S.S.R. a/	226,000	1,084	11	1,095	0.48
West Germany	66,720	209	44	253	.38
Japan	36,715	50	142	192	.52
France b/	56,260	87	687	774	1.38
Italy	30,785	52	2	54	.17
United Kingdom	69,160	223	158	381	.55
Canada b/	35,300	---	58	58	.16
United States	503,200	2,028c/	1,796d/	3,824	.78

a/ Excludes loans and grants to Soviet bloc countries.

b/ Disbursements; commitments not available.

c/ Includes DLF, ICA, Public Law 480 (title I), and Export-Import Bank.

d/ Includes MSP (ICA), Public Law 480 (titles I, II, and III), and other (malaria eradication, etc.).

Source: The International Development and Security Act, hearings, House Committee of Foreign Affairs, 87th Congress, 1st session, on H.R. 7372, June, 1961, pt. II, p. 819

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FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

SUMMARY

Agenda Item: D.1

United States of America

THE PROVISION OF ADEQUATE CAPITAL FOR INDUSTRIALIZATION

By Alfred C. NEAL,
President,
Committee for Economic Development,
New York, N.Y.

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No. 732
D.1

THE PROVISION OF ADEQUATE CAPITAL FOR INDUSTRIALIZATION

by

Alfred C. Neal, President, Committee for Economic Development
New York, N. Y.

SUMMARY

1. Provision of adequate capital for industrialization depends upon reasonable stability in those conditions which affect the prospective rate of return on capital. The foremost of these conditions are political stability and good government administration. There is no paradox in the fact that most investment is concentrated in developed countries with current rates of return less than those in less developed countries; the discount for risk and uncertainty accounts for most of the difference. This phenomenon is a consequence of rational calculation, not necessarily of differences between economic systems.

2. For foreign capital investment in less developed countries, the stability conditions have additional content. The prospective return on investment is dependent not only upon domestic stability in the recipient country but also upon stability of their exchange rates.

3. In addition to these general conditions, there are other indispensable conditions with respect to the supply and quality of the other factors which must be directly combined with capital to produce industrial goods. Of these, the most important is management, especially because management can overcome deficiencies in other factors. Finally, for successful use of capital in industrialization there must be an adequate supply of workers well enough educated, trained and motivated to perform the tasks assigned to them. Capital, management, labor and markets are as essential to successful industrialization as four legs to a horse. And, just as a horse may require a road to run with any speed, stable and efficient government providing a good investment climate is required if industrialization is to progress with reasonable speed.

Lessons from the Developed Countries in Meeting Gaps in the Supply of Capital

4. Capital for industrialization consists essentially of three types: (1) short-term loans for financing current operations, inventories, and accounts receivable; (2) intermediate and long-term loans (over ten years) for financing plant and equipment; and (3) equity capital, the permanent capital supporting the whole enterprise which also provides a margin of security for all types of loans.

5. Developing countries usually lack adequate institutions for providing either equity capital or longer-term loans to industry. Because the smaller and rapidly growing industrial firm is likely to predominate in such countries, and because such firms may be expected to encounter the most serious capital shortages, special attention to this type of financing is called for. What is very much required in the developing country, therefore, is a substitute for the capital market and its institutions, a substitute that performs the same economic functions. Such a substitute should, so far as possible, be a channel

linking the capital markets of developed countries and the capital supply of international agencies to the capital needs of developing countries. A type of institution to meet this range of financing needs is comparable to the special institutions which have been successfully pioneered already to fill the gaps in longer-term and equity financing in the developed countries. It is usually called a development bank.

Domestic vs. Foreign Sources of Capital

6. The possibilities of using foreign capital are limited by the capacity to generate foreign exchange. To use foreign capital for investments not related to such a purpose invites default on foreign obligations and the consequent drying up of the foreign sources of supply. Domestic, not foreign, sources are expected to supply the major part of the capital required for development.

7. Experience to date argues strongly for industrialization that clearly meets two requirements: (1) It uses capital most efficiently, which is best measured by projects yielding the highest discounted return over cost and (2) it fits into a total development program which will adequately meet the payments in foreign exchange entailed in its financing.

Economies of Scale and the Problem of Markets

8. There is a wide range of products that can be made in smaller plants serving limited markets. At the other end of the scale, certain manufactures are likely to be carried on only with very large investments and primarily for export. Examples are aluminum and copper. There is a wide range of other manufactured products which, to support optimum size plants, require markets far larger than those available in one developing country or even a contiguous group of them. The economies of scale require plants of such large size for many products that developing countries would have to form customs unions to justify their establishment if they wish to produce reasonably low-cost products. In these cases, nationalism is the enemy of efficiency.

9. Typically, the rate of interest from domestic sources in less developed countries for financing small undertakings is very high. Projects which are economically justified in the eyes of the foreign lender or investor may contribute far less to the productivity of the developing country, per unit of capital investment, than would equivalent investments in a number of small manufacturing plants able to earn the going rate of return in the developing country. To secure optimum size plants which will be competitive with foreign sources of supply, and to secure maximum returns from the limited supply of capital available to them, most developing countries would be well advised to establish development financing institutions which concentrate upon smaller plants capable of earning the high domestic rate of return on capital, particularly when foreign capital to finance such development financing institutions is available at relatively low cost.

10. The considerations discussed in this paper seem to demonstrate that conditions largely within the control of the developing countries would appear to determine whether larger supplies of capital can be made available and can be effectively used.

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CONFERENCIA DE LAS NACIONES UNIDAS
SOBRE LA APLICACION DE LA CIENCIA Y LA TECNOLOGIA
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Punto del programa : D.3.4 Argentina

EL USO DE RADIOISOTOPOS PARA RESOLVER PROBLEMAS ESPECIALES EN LA INDUSTRIA

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EL USO DE RADIOISOTOPOS PARA RESOLVER PROBLEMAS ESPECIALES EN LA INDUSTRIA

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1. El panorama del empleo de material radioactivo en los países en estado de desarrollo ofrece aspectos muy particulares cuando se refiere a las aplicaciones industriales. En efecto, mientras que en casi la totalidad de las disciplinas científicas o científico-técnicas la difusión de los radioisótopos está condicionada fundamentalmente por el grado de adelanto alcanzado en aquellas disciplinas, en el campo industrial existen otras limitaciones, que son estrictamente de carácter económico.

2. Tales condiciones, si bien representan obstáculos adicionales para el desarrollo de los programas de difusión del uso de radioisótopos, permiten en cambio una mayor seguridad en la estimación de la evolución futura del mercado, al suministrar una cantidad de parámetros de los que no se dispone en el análisis de la marcha de otros campos de aplicación.

3. En lo que sigue se intenta establecer los parámetros mínimos que deben caracterizar las regiones en estado de desarrollo para que el empleo de material radioactivo en la industria tenga sentido, y las condiciones a establecer para asegurar la aceptación de estos nuevos elementos de trabajo por parte de los empresarios, a la luz de la experiencia adquirida y la tendencia visible de estas actividades en la República Argentina.

4. Dado que el tema se refiere a regiones en estado de desarrollo, se da por sobreentendido que el hipotético país de que se trata tiene un cierto grado de evolución industrial, por lo que entre los parámetros exigibles no figurará la existencia misma de una industria en funcionamiento.

5. En cambio, deben darse los siguientes parámetros mínimos:

   a) La industria local debe encontrarse en estado de expansión.

   b) Debe existir competencia interna entre industrias del mismo ramo.

   c) El país debe contar con un cierto grado de estabilidad monetaria.

6. El primer parámetro exigible indica que rara vez una industria estática incorpora nuevos procedimientos al control de su producción, sobre todo si tales procedimientos implican inversiones de cierta magnitud. Similarmente, la existencia de una industria estática es tácitamente opuesta a la instalación de nuevos procesos de producción. Dado que el control de producción y los nuevos procesos de producción son los campos más desarrollados del empleo industrial de radioisótopos, se deduce que una industria que no se encuentre en expansión y el uso de radioisótopos son antinómicos.

7. Este primer parámetro es fácilmente mensurable a través de las estadísticas comerciales; el análisis de la emisión de acciones y las variaciones de capital invertido, el estudio de las memorias anuales y la simple lectura de los planes de producción permiten identificar fácilmente qué industrias de una región se encuentran en estado de expansión, y aún su grado de expansión relativo.

8. El segundo parámetro ha probado ser de existencia imprescindible. La falta de competencia interna constituye una barrera infranqueable para todo propósito de mejorar la calidad de la producción, principal beneficio ofrecido a la industria por el empleo de radioisótopos. En consecuencia, se torna muy dudosa la colaboración que la tecnología nuclear pueda prestar a la industria, cuando ésta no siente el acicate de la competencia interna.

9. Se hace específica mención de la competencia interna, porque normalmente la externa no existe en los países en estado de desarrollo, eliminada por las barreras aduaneras.

10. La existencia y valoración del segundo parámetro es más dificultosa de lo que aparentaría a primera vista. Para que la competencia interna exista no basta con que el país disponga de varias plantas dedicadas a la producción de un determinado renglón, es necesario además que dichas plantas sean efectivamente independientes entre sí, para que la instauración de trusts y otras figuras jurídico-comerciales no invalide el concepto de competencia, y más que nada, el mercado debe ser un mercado de oferta y no de demanda, porque en este último caso la libertad de elección del público consumidor, y por ende la presión en pro de la mejora de la calidad, son sólo teóricas.

11. Se puede apreciar así que la medición de este segundo parámetro sólo puede hacerse luego de un cuidadoso estudio del mercado, y disponiendo del conocimiento real de la situación legal de la industria en el país en cuestión.

12. El tercer parámetro mínimo se explica por sí mismo. La inestabilidad económica frena en términos muy breves la expansión industrial, dificulta la formulación correcta de planes de producción y torna ilusoria la competencia en calidad. Está suficientemente comprobado que la inestabilidad

de la moneda, al afectar a la masa de las operaciones industriales, afecta como derivación lógica al uso de radioisótopos en el control de producción o en los procesos de producción.

13. Si la investigación realizada sobre la existencia de los tres parámetros mínimos enumerados en el párrafo 5. suministra información positiva para un sector industrial o varios, la siguiente etapa aconsejable en la tarea de promoción del uso de radioisótopos es la de establecer condiciones favorables para que el ambiente empresario encuentre conveniente su empleo.

14. Tales condiciones favorables pueden llegar a crearse si se llevan a cabo las siguientes tareas:

a) Difusión de posibilidades de empleo de los radioisótopos.

b) Acceso a la información especializada.

c) Adiestramiento de personal técnico.

d) Disponibilidad de asesoramiento.

e) Equipamiento mínimo de instrumental.

f) Abastecimiento seguro de material radioactivo.

g) Exposición concreta de resultados económicos.

15. La difusión de posibilidades entre los empresarios industriales tiene una importancia capital para el incremento del uso de radioisótopos. La información corrientemente disponible para los sectores productores de los países en estado de desarrollo en cuanto a la energía nuclear y sus posibles aplicaciones pacíficas se reduce generalmente a los temas relacionados con la generación de energía eléctrica y con el transporte marítimo, y probablemente en razón de su mayor significación económica y de su misma espectacularidad. Pocos dirigentes industriales tienen información sobre el hecho real de que, hasta el momento, el beneficio obtenido de la aplicación industrial de los materiales radioactivos supera, por varios órdenes de magnitud, al producido por la generación de energía eléctrica y por el transporte marítimo.

16. La campaña de difusión debe hacer incapié en las técnicas inmediatamente aplicables a las industrias que satisfagan los parámetros mínimos, y debe incluir fundamentalmente una reseña ponderada de los beneficios económicos previsibles que derivarían de la introducción de nuevos métodos de control o de producción basados en el empleo de materiales radioactivos. Los medios a emplear pueden ser varios, desde las conferencias públicas hasta los artículos especializados en las revistas técnicas, pero parecen obtenerse más rápidos resultados con los folletos concisos que

llegan a los niveles técnicos directivos de las industrias en cuestión.

17. El acceso a la información especializada constituye el paso lógico que solicitarán los dirigentes interesados por la campaña de difusión. En general, y por las características de la actividad mundial en energía nuclear, la información especializada se concentra en cada país en un determinado organismo nacional; a esa concentración de información debe asegurarse que los industriales interesados tengan acceso rápido y eficiente, lo que puede promoverse por la distribución periódica de boletines bibliográficos particularizados por campos de aplicación, y de boletines informativos o publicaciones técnicas sobre el tema en cuestión.

18. El adiestramiento de personal capacitado para la operación de las técnicas que se desea promover es una tarea imprescindible para la difusión del uso de radioisótopos, que en el aspecto de las aplicaciones industriales debe hacerse con un criterio particular. En efecto, nunca debe perderse de vista el objetivo perseguido, que es el de capacitar a un técnico para una determinada tarea; esta decisión evitará que se corra un riesgo muy usual en los cursos de capacitación, que es el de su paulatina derivación a los programas enciclopédicos. El ambiente industrial se mostrará reacio a comprometer el tiempo de sus técnicas en la asistencia a cursos que amenacen ser demasiado académicos, y preferirá siempre métodos más expeditivos para el adiestramiento de su personal, aunque sean más empíricos.

19. El método más adecuado para el adiestramiento de personal destinado a emplear las técnicas radioisotópicas en la industria parece ser el de incorporar a los técnicos interesados a los laboratorios que ya estén trabajando en esos temas; esta línea de conducta ha probado ser más efectiva, en el caso de usos industriales, que el dictado de cursos regulares.

20. La disponibilidad de asesoramiento tiene gran importancia en el desarrollo de las aplicaciones industriales de los radioisótopos, sobre todo en las primeras etapas de crecimiento. En esos momentos, los técnicos adiestrados no tienen normalmente el respaldo propio de una larga experiencia en el trabajo que facilita la resolución de las inevitables dificultades imprevistas que suele acompañar a toda nueva actividad. Para el fácil acceso al asesoramiento, alcanza ahora toda su significación el haber adiestrado al personal técnico por el método preconizado en 19., pues el trabajo conjunto en los laboratorios especializados ha puesto en contacto a los que se inician en cada disciplina con quienes tienen la capacidad de orientarlos en la resolución de sus problemas específicos.

21. El asesoramiento puede y debe llegar más lejos que la sim-

ple ayuda al personal técnico; muy a menudo debe tener como destinatarios a los dirigentes industriales, que plantean la existencia de problemas que aun no están preparados para encarar. En estos casos, el asesoramiento no sólo debe cubrir el análisis completo del problema y su probable solución, sino también la indicación de la forma de encararlo y la información encaminada a poner en operación los medios humanos e instrumentales que posibiliten la realización del proyecto.

22. La cuestión del instrumental necesario para realizar la aplicación industrial de radioisótopos puede llegar a constituir una de las trabas mayores para una rápida aceptación del material radioactivo en el ambiente empresario. En los países en estado de desarrollo se dispone, generalmente, de una industria electrónica incipiente, cuya capacidad de absoración de demanda de instrumental especializado es muy limitada, frente a la competencia de la clásica demanda de equipos y artefactos electrónicos convencionales; en consecuencia, es improbable que pueda contarse con esa industria para abastecer la compleja línea de equipos que algunas aplicaciones requieren.

23. La solución a este problema parece ser la adopción de una política mixta, que incluya en las primeras etapas de promoción el impulso de técnicas que no requieran instrumental de difícil obtención, combinado con la instalación de servicios centrales bien dotados que realicen tareas a pedido, bajo contrato. Paralelamente, debe iniciarse una campaña para lograr que una o más de aquellas industrias electrónicas se dedique a la construcción rutinaria de equipos básicos de detección, bajo las directivas y el asesoramiento de estos servicios centrales.

24. De esta manera puede llegar a tenerse en marcha una buena cantidad de técnicas que no requieren instrumental o que utilizan instrumental mínimo fabricado localmente, estando siempre disponibles para la solución de problemas especiales los laboratorios de los servicios centrales, dotados del instrumental más complejo y de mayor significación.

25. Todas las operaciones previas deben apoyarse en un abastecimiento seguro y confiable de material radioactivo. Los radioisótopos que eventualmente se produzcan localmente, en aquellos países en estado de desarrollo que cuenten con reactores nucleares y/o máquinas aceleradoras, deben originarse en servicios de producción que funcionen a régimen comercial, con seguridad en las especificaciones y en los plazos de entrega. El material radioactivo que se adquiera en el exterior, que constituirá la mayor parte del utilizado en la industria, debe estar sometido a un proceso de adquisición, importación y entrega excepcionalmente ágil, evitando las clásicas dificultades aduaneras.

26. En los países en estado de desarrollo, el método aconsejable es la centralización de todas las operaciones de comerciali-

zación en un solo organismo, que se encargará del contacto con los centros productores, de la introducción rápida al país en cuestión y de la entrega al usuario autorizado.

27. La última etapa a cumplir en esta tarea de promoción es la exposición concreta de resultados, con énfasis especial en su significado económico. Debe recordarse que las aplicaciones industriales de los radioisótopos tienen, generalmente, el factor económico de la producción como único justificativo, de manera que debe insistirse, sobre todo en las primeras épocas de difusión, en los beneficios alcanzados en una operación determinada.

28. Es conveniente que en la misma exposición concreta se haga referencia a las condiciones sanitarias en que el trabajo ha sido realizado. Si bien cada aplicación de material radioactivo implicará la previa autorización legal para su empleo (que implicará la existencia de personal capacitado, la disponibilidad de instrumental necesario, la instalación de laboratorios o zonas de trabajo considerados seguros desde el punto de vista de la física sanitaria y la vigilancia rutinaria de las condiciones de trabajo por medio de inspecciones visuales y monitoraje personal y de áreas), es necesario destacar periódicamente los resultados alcanzados en la tarea de protección, de manera de ir creando entre dirigentes y operarios la conciencia de la seguridad y la ausencia de riesgos que puede obtenerse por medio de una labor inteligente en el empleo de materiales radioactivos.

29. Cuando, con posterioridad a la consolidación de los métodos radioisótópicos en las aplicaciones biológicas y médicas, se decidió en la República Argentina la promoción de las aplicaciones industriales, se procedió a realizar el estudio de posibilidades que implica el establecimiento de los parámetros mínimos detallados anteriormente. Si bien el método seguido no fué exactamente el aquí aconsejado, las variantes introducidas son las aconsejadas por la experiencia, ante los errores de apreciación cometidos.

30. El establecimiento de aquellos parámetros mínimos permitió definir una serie de industrias, y en particular, una serie de líneas de producción industrial, en las cuales el aporte de las técnicas radioisotópicas podía ser de inmediata utilidad. La combinación de esta información con la capacidad de asegurar las condiciones que se ha venido enumerando como necesarias, llevó a la decisión de iniciar las actividades en el campo de la gammagrafía industrial.

31. Hace algunos años, en el momento de tomar esa decisión, existía ya en la República Argentina una industria metalúrgica liviana y semi-pesada en estado de gran desarrollo, con un mercado que comenzaba a transformarse en mercado de oferta, con las numerosas empresas compitiendo enérgicamente, y con una moneda razonablemente estable. A estos pará-

metros positivos se agregaban la mayoría de las condiciones deseables para iniciar el trabajo: se disponía de información suficiente para difundir las posibilidades de la gammagrafía industrial, se podía asegurar el acceso a esa información, se estaba en condiciones de adiestrar al personal de la industria y la ya vieja tradición de la radiografía industrial convencional facilitaba el asesoramiento. Por otra parte, las necesidades instrumentales para este tipo de técnicas eran mínimas, y la Comisión Nacional de Energía Atómica estaba en condiciones de asegurar el abastecimiento de material radioactivo.

32. Ante esas circunstancias favorables, se inició el trabajo de un laboratorio especial en la puesta a punto de las técnicas de trabajo, y se comenzó la tarea de promoción junto con el ofrecimiento de servicios de gammagrafía, destinados fundamentalmente al ensayo no destructivo de piezas fundidas y soldadas.

33. Tres años de trabajo continuo en el desarrollo de técnicas y materiales, en el diseño y construcción de equipos de irradiación y en la prestación de servicios de gammagrafía que incluyeron tareas tan disímiles como la verificación de la fundición de bielas en grandes motores Diesel, la ubicación de armaduras de hierro en viejas estructuras de hormigón armado y el control de calidad de soldadura en tanques a presión y canalizaciones de vapor para usinas eléctricas, han conducido a la situación actual. En la República Argentina existen ya dos empresas privadas dedicadas a la construcción de equipos de gammagrafía industrial, cuatro que realizan trabajos de gammagrafía para terceros, y varias empresas industriales que han incluído los equipos y métodos gammagráficos entre su dotación de control de producción, desde fundiciones que producen motores para la fuerte industria automovilística local, hasta talleres que construyen tanques para el almacenamiento de propano.

34. La buena marcha de esta primera etapa del programa de promoción permitió iniciar un segundo proyecto, destinado a la misma industria metalúrgica liviana y semi-pesada, y a la industria plástica. Teniendo en cuenta la aguda necesidad de elementos de control y la experiencia ya adquirida en los laboratorios de la Comisión Nacional de Energía Atómica, se decidió comenzar la construcción de prototipos de equipos medidores de espesores de productos laminados y de equipos medidores de nivel.

35. En el primer campo, sobre todo, se alcanzó una repercusión notable en el ambiente industrial. Una línea completa de equipos, operando en base a los fenómenos de absorción pacial y de retrodispersión, se mostró apta para medir espesores de materiales como las láminas de delofán, de pocos micrones de espesor, o los flejes de acero laminado de algunos milímetros. En la actualidad existe en el país una empresa privada que construye estos equipos sobre los prototipos desarrollados por los laboratorios de la Comisión

Nacional de Energía Atómica, y varias industrias locales, como laminaciones, fábricas de tubos, fábricas de papel y de materiales plásticos, que han instalado estos equipos, cuyo costo local es muy inferior al de los similares de importación. Esta circunstancia ha permitido iniciar las primeras negociaciones para exportarlos a otros mercados.

36. Paralelamente al desarrollo de esta tarea de promoción en el campo de los equipos de control, se comenzó la instalación de laboratorios preparados para la realización de operaciones analíticas y con trazadores, que por ser en general de carácter ocasional, eran de improbable instalación por la empresa privada. Tales laboratorios de la Comisión Nacional de Energía Atómica fueron dotados del instrumental especial imprescindible, y comenzaron a ofrecer sus servicios a la industria.

37. Esta centralización de técnicas, equipos y especialistas permitió poner a disposición de la industria y de otras ramas de la actividad del país, algunas utilísimas aplicaciones de los materiales radioactivos que, de otra manera, no hubieran tenido posibilidad de ser encaradas por el usuario ocasional en razón de las fuertes inversiones iniciales necesarias.

38. Estos laboratorios realizaron múltiples y variadas tareas, en general sobre la base de trabajo tarifado. Así, por ejemplo, se llevó a cabo una determinación completa de la marcha del clinker en hornos cilíndricos rotatorios para la producción de cemento Portland, se determinaron las interconexiones ocultas en redes de distribución de gas, se constataron las causas de la distribución irregular de anilinas en tejidos, se midieron caudales de ríos torrentosos, se determinó la velocidad de avance de napas acuáticas subterráneas, se realizó en reiteradas ocasiones la localización de raspadores en oleoductos, se determinó el movimiento de arenas en la boca de un puerto y se llevaron a cabo análisis por activación de diversos materiales, llegándose a intervenir en peritajes legales en procesos por envenenamiento.

39. La enumeración que antecede es ejemplificativa y no taxativa, pero la variedad de temas abarcada basta para indicar la cantidad de problemas especiales que existen sin duda en la industria de un país en estado de desarrollo, y cuya resolución puede ser encarada en forma relativamente sencilla con la adopción de una línea de trabajo como la indicada.

40. Para las actividades futuras se ha llegado a establecer, siguiendo el mismo método hasta aquí detallado, que existen buenas posibilidades de ampliar los programas de aplicación de material radioactivo, iniciando servicios de irradiación con fuentes de muy alta actividad para los sectores productores de plásticos y de conservas alimenticias.

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SUMMARY

Agenda Item: D.3.4 **Argentina**

THE USE OF RADIOISOTOPES TO SOLVE SPECIAL INDUSTRIAL PROBLEMS

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Papers have been contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas as working papers for that Conference. They are published as presented by the contributors, and the contents and the views expressed are those of the contributors. (See notes overleaf.)

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THE USE OF RADIOISOTOPES TO SOLVE SPECIAL INDUSTRIAL PROBLEMS

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SUMMARY

This study reviews experience and trends in the use of radioisotopes in industry in developing regions.

In the first place it deals with the minimum parameters which must be a feature of such districts so that the use of radioactive material in industry may be economically worthwhile and it goes on to discuss the conditions necessary to ensure acceptance by employers of these new tools: spread of possibilities, access to information, training of staff, availability of advice, minimum instrumental equipment, assured supply of radioactive material and concrete presentation of results.

The second part of the paper is devoted to explaining the process accomplished in the Argentine Republic. The activities and prospects for the immediate future are enumerated together with a description of the operations carried out.

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Agenda Item : D. 5. 1

Italy

THE ITALIAN CONTRIBUTION TO THE DEVELOPMENT OF THE PULP AND PAPER INDUSTRY IN CERTAIN COUNTRIES UNDER INDUSTRIAL DEVELOPMENT

By Ing. Giuseppe VIOLA

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THE ITALIAN CONTRIBUTION TO THE DEVELOPMENT OF PULP AND PAPER INDUSTRY IN CERTAIN COUNTRIES UNDER INDUSTRIAL DEVELOPMENT

By Ing. Giuseppe VIOLA

I - It is well known that the demand of pulp and paper has been growing in the world with a continuous, increasing trend, in tight connection with the industrial development and consequent improvement of the standard of living: this phenomenon is more remarkable in the "new countries", where the effort for a general industrialization is particularly deep. The world paper demand for the next years has been evaluated, and the prospects can be summarized as follows:

Region	Paper			Board			Total paper and board		
	1955	1965	1975	1955	1965	1975	1955	1965	1975
1. North America	18,599	24,470	32,390	12,923	18,315	26,220	31,522	42,785	58,610
2. Latin America	1,469	2,780	5,125	353	700	1,405	1,822	3,480	6,525
3. W. Europe	9,881	15,705	21,620	3,272	5,595	8,585	13,153	21,300	30,215
4. E. Europe	1,355	2,705	4,615	535	1,240	2,440	1,890	3,945	7,055
5. U.S.S.R.	1,900	4,460	8,590	575	1,650	3,755	2,475	6,115	12,345
6. Africa	415	755	1,340	71	140	265	486	890	1,605
7. Near and Middle East	107	210	390	32	65	135	139	275	525
8. Far East	2,226	4.835	9,165	766	2,045	4,670	2,992	6,880	13,835
9. China (Mainland)	698	2,405	6,645	170	680	2,180	868	3,085	8,830
10. Oceania	578	905	1,245	182	360	590	760	1,265	1,835
World total	37,220	59,230	91,130	18,870	30,790	50,250	56,090	90,020	141,380

These prospects have, as a consequence, posed the problem of the sources of suitable raw-materials for the production of pulp and paper to fulfill the increasing demand economically. The traditional areas, where the pulp and paper industry was practically born and had its prevailing development, are those concentrated between 40th and 65th parallel in the Northern Emisphere: spruce and pine have been, for many years, the basic raw materials for the paper industries: however, between the two world wars, and especially after the second world war, other raw materials have been taken into consideration, and good industrial results have been obtained. The progress in the technique and technology of the pulp and paper industry, the development of new processes have

broadened the field of choice of the raw materials: besides the hardwoods, which pulping has entered now into the industrial practice, also annual crops and agricultural residues have been used, and their utilization has now become quite usual.

In Italy, a country with very reduced forestal resources, the employ of cereal straw for the production of low grade wrapping paper has been always practiced, but in the last 40 years, new processes have been developed for the production of bleached pulp from straw, to be employed up to high percentages in various quality papers. For instance, the soda-chlorine process, which is now considered a classical one for pulping this kind of raw material, was born and has been developed in Italy. This process has been applied in many countries and in the last 30 years the possibility of basing the paper industry also on straw has been experimented in South America, Africa, Asia. A raw material having properties similar to straws, but presenting even more favourable conditions for the pulp industry, is the sugar-cane bagasse. It practically grows between 30° North, and 30° South, i.e. in all tropical and sub-tropical areas: it is the part of the world, where most of the countries under industrial development lie, and certainly the possibility of utilizing this material, which at present is burned in the sugar mill furnaces, is a very promising opportunity.

It is to be remarked that, when considering the various factors for establishing new industries, the possibility of using indigenous raw-material is of the greatest importance: the shortage of foreign currencies is to be considered as normal and unavoidable when a Country is producing its biggest effort to develop its industrial organization, and consequently any way to reduce the importation of products which can be produced locally, is to be considered as a favourable condition. Furthermore, the local production helps the increase of consumption probably at an higher rate than in the case the product should be imported.

For these general reasons, the various States, the International Authorities, the industrial groups, during the last years have devoted a continuously increasing attention to the problem of utilization of straws, grasses, bagasse.

II - The various processes available

Various are the processes available for the pulping of raw materials like agricultural residues, grasses, etc. The most important are compendiously described below:

The Conventional Soda Process

This process is used for the production of blea hed pulp and in some mills for the production of high quality board. The cooking is performed in rotary globe digesters or tumbling type pressure digesters, employing high chemical concentration (up to 20%) at high temperature

(170°C). The cooking time is about 2÷3 hours and the complete Cooking cycle is 5 hours. The yield is rather low in comparison with the other processes and also the characteristics of the obtained pulp are affected by the drastic action of the high chemical concentration at elevated temperature.

The soda process requires a high initial investment, necessary for the pressure digesters and for the auxiliary equipment.

Whereas possible, in the recent years, this process has been modified in the sulfate process.

The Sulfate process

This process has been developed in the past thirty years and has almost replaced the soda process for the production of alkaline pulp. The process is practically similar to the soda process, except that the loss of soda in the recovery system is made up by the addition of salt cake (sodium sulphate) instead of soda or caustic soda. The cooking liquor contains sodium sulphide, which presence results in a milder action, giving a slightly increased yield of pulp.

The sulphate process, like the soda process, requires a high initial investment, because it is absolutely essential to install a recovery system, in order to reduce the sodium sulphate into sodium sulphide. A disadvantage of this process is the most disagreable odour, due to the organic sulphur compounds formed in the reaction under high pressure.

Notwithstanding many efforts made in the last years, it is to be noted that the chemical recovery system does not work satisfactorily when using raw materials containing high silica content, like for example rice straw. Up to now no satisfactory recovery system seems to have been found in order to overcome this inconvenience.

The monosulphite process

The sodium monosulphite process has become widely used in many countries for the production of straw pulp and bagasse pulp. The principal cooking agent consists of sodium sulphite which is buffered with sodium carbonate, sodium bicarbonate or caustic soda during the cooking operation. Being the sodium sulphite a mild cooking agent, high pressures are required in the digesters.

From a technical point of view, the monosulphite process is one of the most suitable of all the conventional professes in which pressure digesters are used. From the economic point of view, this process may be successfully adopted provided that the monosulphite is obtainable as by-products of the chemical industry. However, in certain countries, where the cost of the chemical, not obtainable as by-product, is very high, the use of this process may prove not feasible at all.

The Soda-Chlorine process

This process is rather widely used all over the world for pulping agricultural residues. In this process a mild caustic soda cook at atmospheric pressure is followed by a chlorination stage and alkaline treatment which continue the extraction process. These stages are followed by a bleaching with hypochlorite.

In the soda chlorine process the products of an electrolytic plant can be used in approximately the ratio in which they come from the cells. This is attractive to countries which have no established chemical industry, but possess plentiful supplies of salt and low cost power.

This process running at atmospheric pressure, requires an initial investment lower than that for the other pressure processes.

The problem of the choice of the more suitable process depends on many factors, among which we would like to mention:

- the local prevailing conditions in respect of raw material availability, cost of chemicals and the final product required;
- the size of the mill to be installed, with particular regard to its initial output, and possible future expansion;;
- simplicity of installation, in connection with training of personnel and, more in general, smooth plant operation.

Without entering into many details, the general suggestions to be born in mind are the following ones:

- The type of available local raw material better than the selling marketing conditions, should condition the selection of the grade of product to be obtained. In fact, when a certain raw material is converted into the more appropriate final product by the more suitable industrial process, it is most probable that the production costs are comparatively lower, and the local product can thus compete favourably with imported similar goods. As an example, sugar cane bagasse can be pulped as semi-pulp to give an excellent and economic corrugating medium, or, alternatively, pulped as bleached pulp for high grade writing and printing papers, both final products being in position to compete favourably with the same products obtained from conventional raw materials.

- When determining the size of a new mill, it should be considered that the local production promotes the consumption considerably, and also, in the case the general conditions are favourable, that the marketing area is likely to be broadened by exporting to neighbouring countries.

- When installing a new factory in a country in phase of industrial expansion, a very important factor is to select the simplest process and the most experienced type of equipment: to sum up this general rule in a "slogan", it would be recommended "New processes in old countries, old processes in new countries".

A very important point is finally the "human factor": at the same time when installing a new industry, it is necessary to prepare the required

personnel, by training local people and by preparing "running-in" groups, that could give substancial cooperation to the growing new activity.

II - Two Samples of integrated paper plants, recently realized by the Italian Industry in South East Asia

It is interesting now to examine two recent cases in which the Italian industry has given a substancial cooperation to the establishment of a new factory in countries under industrial development: we mention the Pabrik Kertas Blabak, in Java (Indonesia) and the COGIDO Paper Mill, near Saigon (Viet-Nam).

In both cases, State Authorities (Bank Industri Negara, and Crédit Commercial du Viet-Nam) which had never directly exploited the paper industry, after careful examination of the local raw material availability, of the marketing conditions and of the possible processes available, decided to avail themselves of the cooperation of Italian Industry, which could offer the necessary general guarantees and provide technical and financial help.

The Blabak Pulp and Paper Mill was designed for a production of 7000 tons per year of writing and printing papers; it uses bleached pulp obtained from rice straw and bagasse, by soda-chlorine process. The plant is composed of the following departments:

a) Paper mill consisting of stock preparation, paper machine and finishing room.
b) Pulp plant consisting of straw and bagasse cleaning, cooking, screening and bleaching.
c) Chemical production consisting of electrolytic room producing the required chemicals from salt.
d) Steam and Power plant consisting of boilers and Diesel engines.
e) Auxiliary departments consisting of hydric station, maintenance workshops and laboratory.

The Cogido Pulp and Paper mill designed for a production of 7500 tons per year of writing, printing and wrapping papers; it also uses bleached pulp obtained from rice straw and bagasse by soda-chlorine process. The plant is practically composed of the same departments of Blabak Mill.

Out of these cases the experience has proved that the cooperation between the new countries promoting the new enterprise can attain the full success, provided that the following points are ensured:

- Full mutual support in the designing and construction work: the success depends mainly on the cooperation of the local forces and organization, because the foreign experts, who will follow the realization on the spot, can ordinarily give only a general supervision on the new enterprise.

- Financial help, by allowing reasonably deferred payment terms for the factory's equipment; a certain participation in the enterprise by the plant supplier is advisable, provided that fair conditions for the investment pay-back and profit transfer are foreseen.
- Technical assistance from the supplier to be prolonged until the local staff and organization proves to be fully acquainted with the problems of the new industry. It is to be considered by the local promoter that this technical advice, the cost of which is only a small percentage of the total investment, is one of the most important item of the investment. In fact on this assistance, which should continue for some years after the starting up of the mill, depends in a great degree the full success of the new industry.

In this way some aspects of the problems involved in the paper industry in new countries have been examined, as well as the Italian contribution to a favourable solution of the same.

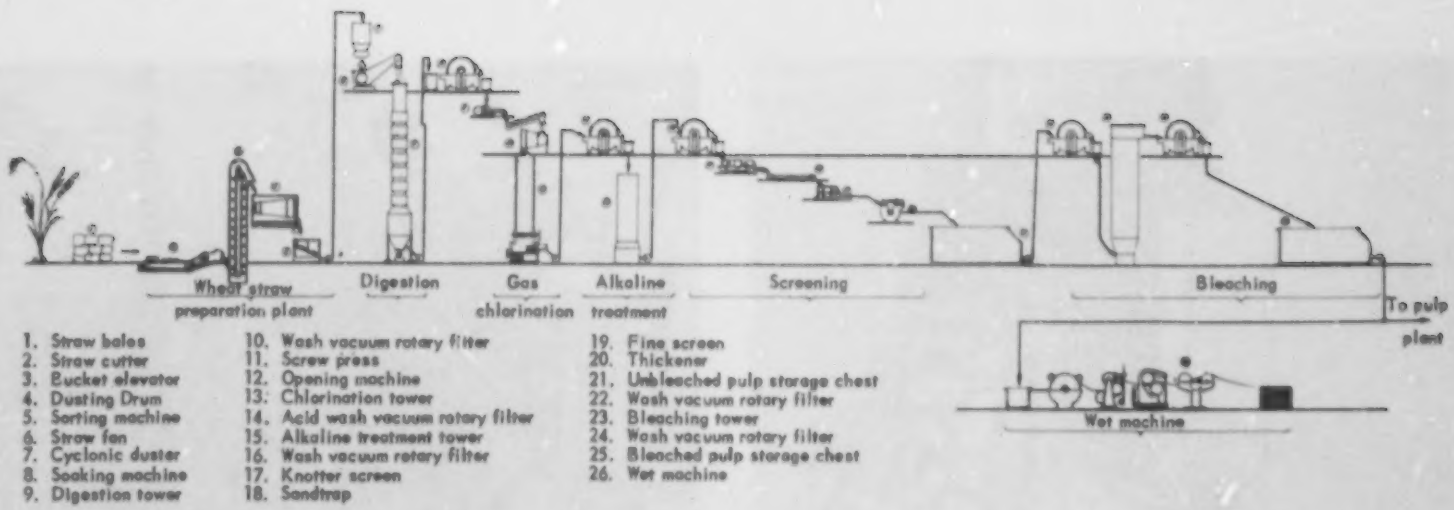
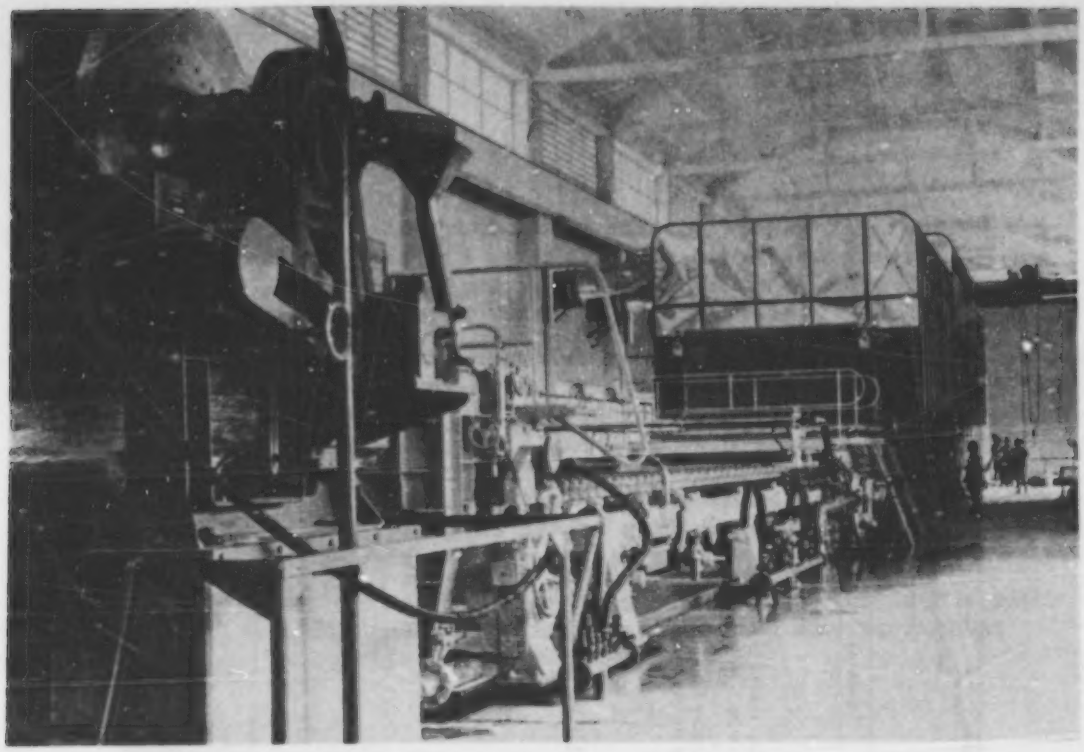
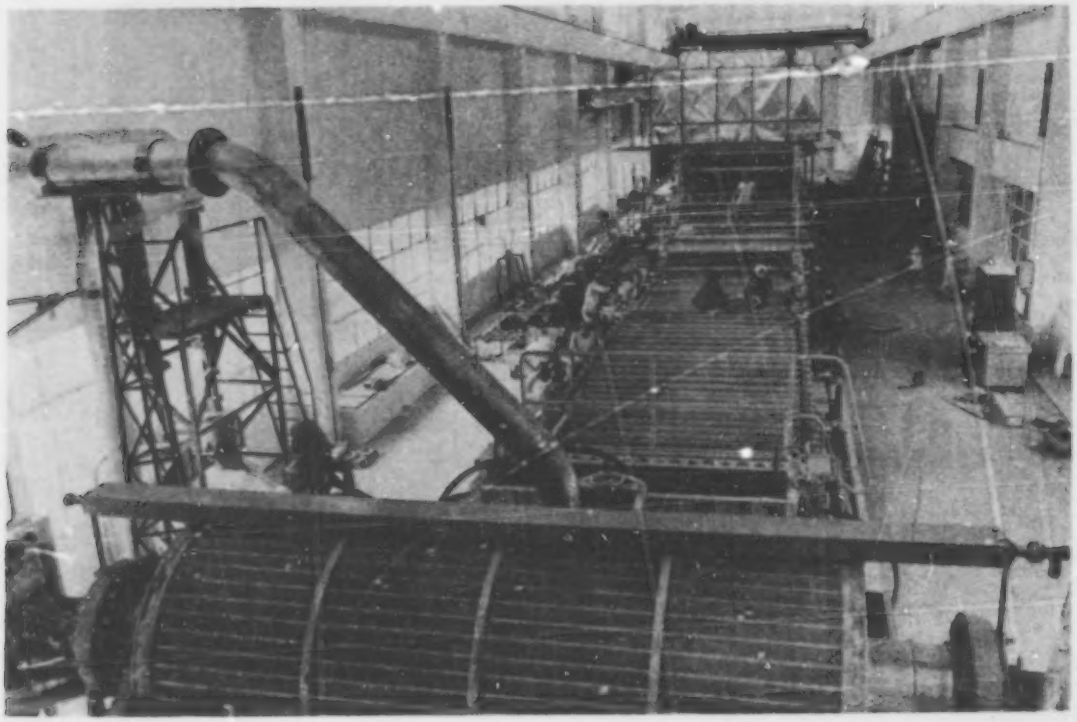


Fig. 1 - Soda-Chlorine Process

Fig. 2 - COGIDO Pulp and Paper Mill - Viet-Nam





COGIDO Pulp and Paper Mill - Viet-Nam

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UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

SUMMARY

Agenda Item: D.5.1 Italy

THE ITALIAN CONTRIBUTION TO THE DEVELOPMENT OF THE PULP AND PAPER INDUSTRY IN CERTAIN COUNTRIES UNDER INDUSTRIAL DEVELOPMENT

By Ing. Giuseppe VIOLA

Papers have been contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas as working papers for that Conference. They are published as presented by the contributors, and the contents and the views expressed are those of the contributors. (See notes overleaf.)

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The Italian Contribution to the Development of the Pulp and Paper Industry in Certain Countries Under Industrial Development

by

Ing. Giuseppe Viola

The expected increased paper demand has posed the problem of the search of new raw materials for pulp and paper industry, particularly in the Countries, under industrialization development.

Cereal straw, sugar cane bagasse and other grasses and annual crops, have proved their suitability for obtaining certain grades of pulp and paper. Due to the local general conditions, wheat straw pulping has been developed in Italy, since after world war I, and Italian plants have been realized in other countries, employing Italian soda-chlorine process.

The selection among the various processes available for pulping local raw materials - and we mention for straw, bagasse, etc the following ones: soda process, sulphate process, monosulphite process and soda-chlorine process - depends on the local prevailing conditions in respect of raw material disponibility and the product to be obtained, the size of the mill and the performances of the installation.

It is essential to choice the right raw material, for the right final product, employing the right process. It will allow, probably, the new industries in new countries, to be competitive with old established competitors. As the smooth operation is essential in new industries, it is recommendable to select simple and experienced processes.

As an example, we mention two factories recently built in South East Asia, with technical and financial cooperation of Italian Industry and local promoters:

- Blabak Pulp and Paper Mill in Djava (Indonesia) having a production of 7000 tons per year of writing and printing papers from rice straw and bagasse pulp.
- Cogido Pulp and Paper Mill in Viet-Nam, having a production of 7500 tons per year of writing, printing and wrapping papers.

From these concrete examples, it must be stated that the technical cooperation, the financial help, under certain agreement, and the careful initial assistance are to be considered as the basis of the development of industry in new countries.

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Agenda Item: D.5.1

Food and Agriculture Organization

IMPLICATIONS FOR DEVELOPING COUNTRIES OF RECENT TECHNICAL ADVANCES IN THE PRODUCTION OF PULP AND PAPER

By Hans Wilhelm GIERTZ

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Implications for Developing Countries of Recent Technical Advances in the Production of Pulp and Paper

by Hans Wilhelm Giertz

1. Until fairly recently papermaking was an art which could only be learnt through a long apprenticeship. The rapidly-growing demand, resulting in mass production of many paper qualities, and the increasing need for speciality products, gradually forced producers to carry out fundamental and applied research directed to improving and developing manufacturing techniques. As a consequence, the postwar decade has witnessed a rapid evolution in the science and technology of pulp and paper manufacture and we have today a much clearer understanding of some of the factors which influence the characteristics and properties of the final product.

2. Generally speaking, most ligno-cellulosic and cellulosic materials of fibrous structure may be processed into some grades of papers and paperboard. Fibres from different raw materials are, however, not alike. They differ considerably in their morphological and chemical characteristics, which make them more or less suitable for papermaking.

3. There are two main reasons why today more than 90 per cent of all the pulp that goes into paper and board manufacture comes from conifers:

(a) The prevalence of coniferous resources in the industrialized regions which account for the preponderant share of the world's consumption and output of pulp and paper and;

(b) The present technical advantage of the long fibres of the conifers over the shorter fibres of deciduous woods and agriculture residues.

4. Among coniferous woods, spruce and other species of the same type such as fir, balsam and hem-lock have occupied a favoured position due to the following reasons:

(a) The wood is soft and has low resin content, making it suitable for grinding

(b) The absence of phenolic heartwood substances such as pinosylvin in combination with the long fibre length make it the most suitable raw material for the sulphite industry

(c) Sulphite pulp was the only type of pulp which could be bleached to high brightness, and

(d) Sulphite pulp was the only type of pulp which could be used for viscose and other dissolving purposes.

The Use of Short Fibre Pulps

5. As will be shown below the pulping and bleaching processes have been developed to such an extent that all kinds of raw materials can be pulped today. For a long time, however, it was considered necessary to use long fibres, i.e. with a fibre length of 2-4 mm, for all kinds of paper, and short fibre pulps, primarily in the form of bleached soda pulps, were only used to a very limited extent as filler pulps. This situation has changed drastically in the last two decades.

6. In the manufacture of printing and writing papers good sheet formation is of greatest importance. Long fibres have always a tendency to flocculate and in order to overcome bad formation when using long fibre pulps the papermaker has to shorten the fibres by beating. Beating, however, adversely influences other and important properties of the paper such as bulk, opacity and tearing strength. When using short fibre pulps good formation is obtained automatically and only a low degree of beating is needed to obtain the necessary sheet strength. At the same time short fibres contribute to smoother surface and higher opacity.

7. It is today a well established fact that the use of short fibre pulps offers a series of advantages in the production of fine papers. It is therefore a tendency to use more and more such pulps in the fine paper industry. Furnishes consisting of 50 per cent short fibre pulps are today ordinary practice in fine paper mills and in many cases 80 per cent is used. Some printing papers are commercially manufactured from 100 per cent hardwood pulp, but for most purposes it is considered necessary to add about 20 per cent of a long fibre pulp to increase the wet strength of the paper web when passing through the press section of the paper machine. This holds specially for fast running machines.

8. In the case of kraft papers, such as wrapping paper and multi-wall bag paper, the requirement in strength is the most important one. For low grade wrapping papers the furnish can be made up of 100 per cent short fibre pulp, or close to it, but in order to meet international standards long fibre pulps have to be added, the extent of which varies with the type of paper.

9. This problem has been studied extensively in Australia where the main raw material for domestic pulp production is short fibre eucalypt wood. Wrapping kraft papers and grocery bag krafts contain 50-60 per cent eucalypt kraft pulp. The most exacting requirement of these products is a high tearing strength and this restricts the amount of eucalypt pulp that can be used. Multiwall bag kraft, which for instance is used for cement and fertilizer sacks, is produced from 35 per cent eucalypt kraft. In this case the specifications for tear and tensile strength are very high.

10. In Mexico and Peru bagasse pulp is used for the same purposes.

11. As will be mentioned later the new technique of making extensible kraft papers might change the ratio of long to short fibre pulps in favour of the short fibre portion.

12. Corrugating board is made of one or several layers of "corrugating medium" covered on one or both sides by "kraft liner" or "chip board". Corrugating

medium used to be and still is to a very large extent produced from waste paper. The same holds for chip board. It is, however, today a well established fact that the best corrugating medium product is manufactured from a neutral sulphite semi-chemical short fibre pulp. Kraft liner is conventionally made of regular pine kraft pulp but also in this case hardwood kraft can be used to a large extent. One mill in Japan produces kraft liner containing 70 per cent mixed hardwood pulp.

13. It is thus clear that for the most important grades of papers, except newsprint, which will be dealt with later, short fibre pulps can be used completely or to a very large extent. What has been said about short fibre pulps in general holds as well for broadleaved wood pulps as for bagasse, straw and other agriculture residue pulps. Bamboo pulp, on the other hand, should be classed as a long fibre type pulp, the bamboo fibres being 2-3 mm long.

Pulping Processes

14. The kraft process is applicable to all kinds of raw materials, such as coniferous woods, all types of broadleaved woods, straw, bagasse and bamboo. The pulp obtained is for each kind of raw material of highest quality. A minor disadvantage is its brown colour and the difficulties involved in bleaching the pulp. The main disadvantage, however, is that the consumption of chemicals in the kraft process is extremely high and amounts to about 400 kg of sodium-hydroxide per ton of pulp. As a consequence the chemicals have to be recovered, and as the equipment needed for the recovery is complicated and expensive, kraft mills have to be built in large units with high capacity.

15. The conventional acid calcium sulphite process is not based on the recovery of chemicals and sulphite mills can therefore be built economically in smaller units than kraft mills. The sulphite process has, however, shown its limitations. For chemical reasons well-known today, it is only possible to cook certain wood species, such as spruce, fir , balsam and hemlock; pine heartwood and other resinous and dense species are not digestible, and most hardwoods and all kinds of "open raw materials", such as straw and bagasse, give very soft pulps. In recent years, however, the fundamental knowledge on sulphite cooking has increased significantly and new types of sulphite cooking seem to offer possibilities of great interest.

16. In the last 20 years the neutral sulphite process has developed rapidly. The process is semi-chemical and the cooked chips have to be defibrated by mechanical means in order to obtain a workable pulp. The pulp is therefore only used for certain grades of paper and mainly for corrugating medium. All kinds of raw materials can be used, hardwood, straw and bagasse being the most suitable. The only base which can be used is sodium, but the consumption of chemicals, which amounts to about 150 kg of sodium sulphite per ton of pulp, is anyhow so low that the process can be economically performed without the recovery of chemicals.

17. In the very last years the so-called bisulphite process has attracted great interest. Today there are a number of mills operating according to this process, some of which are converted sulphite mills and some are mills built specially for this process.

18. Bisulphite cooking is performed under slightly acid conditions at pH 3-5 with a cooking liquor consisting of mainly bisulphite and without excess SO_2. The base can be either sodium or magnesium. Compared with neutral sulphite cooking at pH 7-9, the bisulphite liquor is acid enough to hydrolyse and dis-

solve the lignin. The delignification is therefore fairly complete and results in well cooked chips and a workable pulp. On the other hand, the liquor is not as acid as in conventional acid sulphite cooking (pH 1-2) which means less hydrolysis and thus a higher yield and a stronger pulp. Unbleached, chemical pulps from coniferous woods, are obtained in a yield of about 60 per cent of the wood, compared with 50 per cent for ordinary sulphite and kraft pulps. Bleached pulps, however, are only of somewhat higher yield than conventional bleached pulps. Strength is higher than for ordinary sulphite pulps and can in some respects be compared with that of kraft pulps.

19. An important advantage of bisulphite cooking is that most kinds of raw materials can be cooked. Ordinary sulphite woods as well as pine, including pine heartwood, and different hardwoods are successfully digested in existing mills. For other raw materials such as straw, bagasse and bamboo, the experience is limited.

20. The consumption of chemicals depends greatly on the degree of cooking and the yield of the pulp. Among existing mills some are operating economically without recovery. This holds both for unbleached and bleached pulps, and both for sodium and magnesium base. The fact that the recovery of chemicals is not necessarily needed makes it economically feasible to build small mills (50 daily tons) based on the bisulphite process.

21. In this connection it should be pointed out that there is no fundamental difference in neutral sulphite and bisulphite cooking and that in a bisulphite mill the production can easily be switched over from one type to the other. This makes it possible to cover a very wide range of qualities, from semi-chemical pulps to bleachable grades.

22. Newsprint offers a problem of its own. 75-85 per cent of the furnish consists of mechanical pulp which used to be made of spruce or other woods of the same type.

23. The pitch trouble, which used to arise when using pine groundwood, has now been overcome and many mills all over the world are now producing newsprint from pine wood, which in countries like Chile, South Africa and New Zealand is taken from plantations. At the same time the necessary chemical pulp is semi-bleached pine kraft pulp instead of unbleached spruce sulphite.

24. The grinding of broadleaved woods has still not got its general solution. In the case of light coloured, soft species like poplar, aspen, willow and certain eucalypt species (Tasmania) the mechanical pulp obtained is acceptable for newsprint and magazine papers, but due to lower strength compared with spruce groundwood the portion of chemical pulp has generally to be increased. Dense or coloured hardwoods, to which group most of the tropical trees belong, do not yield an acceptable groundwood with the present grinding technique.

25. The grinding of dense hardwoods has, however, got an acceptable solution in the so-called attrition processes. The chips are first chemically softened and then fiberized in some type of disc refiner. The pulp is obtained in a yield of 80 per cent or higher and is of the same general character as groundwood. This quality can be varied within certain limits and the product substitutes partly the mixture of groundwood and chemical pulp. The chemical presoftening process can be performed either by some kind of neutral sulphite or bisulphite treatment, which has to be done at elevated temperature and under pressure, or according to the newly developed cold soda process. In the latter case and when using a coloured wood raw material the pulp has to be bleached with hypochlorite, peroxide or hydrosulphite. The conversion costs are higher

than for regular groundwood, but this can be more than balanced by the low cost of the hardwood that can be used.

26. A large number of mills of this kind are now in operation all over the world and the pulp is substituting groundwood in newsprint, magazine paper and other low quality printing papers. The new mill at Kulna, Pakistan, is of special interest, because it is based on a domestic broadleaved wood, (gewa) which is partly used as conventional groundwood pulp and partly as a semi-chemical attrition pulp. The long fibre portion consists of an imported semi-bleached sulphate pulp.

27. This new attrition technique is of great interest because it shows that groundwood type pulps can be produced economically from a number of technically important hardwood species which earlier were considered to be of no industrial interest.

28. In this connection it should also be mentioned that processes have been worked out according to which bagasse can be used for newsprint. One mill of this kind is to be built in India.

29. The acid sulphite process is considered to be the most suitable process for the manufacturing of rayon pulp and other types of dissolving pulps. The product is easy to bleach and is of high purity and reactivity. As a consequence, spruce-type woods have been the dominant raw material for the rayon pulp industry.

30. In recent years, however, the development of so-called prehydrolysis-sulphate process has made it possible to use other raw materials than spruce for this purpose. According to this process the digestion starts with a hydrolytic steam treatment at high temperature followed by an ordinary kraft cook. The yield is comparable to that obtained by the acid sulphite process (30-35 per cent) and the product is of very high quality for use in the viscose industry. All kinds of raw materials can be handled. Several mills are based on pine and hardwoods and one on reeds. One mill is under erection in India using bamboo as raw material. The expensive recovery system, however, which is the same as for a regular kraft mill, makes it necessary to build mills of this type in large units.

Papermaking

31. In the field of papermaking the dominant trend in the postwar years has been to increase machine speed in order to raise the production. A prerequisite for high machine speed is a well-trained labour staff. At the same time there has been a tendency to build specialized paper machines, each machine being constructed for a certain type of product. The experience gained in both these fields is of a limited interest for a new paper industry in a developing country. There are, however, some trends in modern papermaking techniques which should be mentioned.

32. The principles of separate beating of paper pulps is now becoming more clearly understood. Separate beating is practised in cases where pulps of quite different character are used together, such as long fibre and short fibre pulps. This technique, which was developed in Australia, makes it possible to increase the portion of the short fibre pulp both in the case of kraft papers and fine papers. It is also present experience that the type of

beater and refiner should be carefully adapted to the type of pulp to be treated.

33. When increasing the speed above 500 mpm on newsprint machines the development of the vacuum pick-up unit was necessary to make it possible to transfer the wet sheet from the wire to the first press. Because of its high cost such a unit is only used on high speed machines and above all on highly specialized newsprint machines. It should, however, be mentioned that the vacuum take-off technique could also be a means of increasing the portion of short fibre pulp in the case of paper machines operating in the medium speed range.

34. For many types of paper, and specially for multiwall sack paper, the extensibility of the paper is of importance. To meet international standards the main part of the furnish has to be a long fibre kraft pulp as has been already pointed out.

35. In recent times methods have been developed according to which the paper, when still wet, is compressed on the paper machine making it extensible after drying. Such papers have shown to possess quite new properties making them especially suitable for purposes like grocery bags and multi-wall sacks. Furthermore, in cases where long and short fibre pulps are mixed, it has been shown to be possible to increase the portion of short fibres, and still keep the properties of a typical kraft paper. One paper mill in Peru is operating according to this process, manufacturing kraft papers with a large portion of bagasse pulp.

36. An ordinary paper machine is not adapted to produce a wide range of different paper qualities and especially not paper and boards varying widely in basis weight. This is a disadvantage of great importance for developing countries.

37. In present times, a new paper machine design is being developed and some units are already in commercial operation. The principle is that the wet web is dewatered upwards instead of downwards, making it possible to apply one layer on the top of the other and still having a very rapid dewatering process. Such machines can operate in the speed range of 50-350 mpm, depending on basis weight, and it is possible to produce paper and boards with greatly varying basis weight. Thus it is expected to be possible to produce on one machine all types of papers, such as tissue, newsprint, kraft papers, printing and writing papers, corrugating medium and kraft liner and at the same time chip board and other boards of not so high basis weight. It should be pointed out that such an all round paper machine is still not in commercial operation.

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FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

SUMMARY

Agenda Item: D.5.1

Food and Agricultural Organization

IMPLICATIONS FOR DEVELOPING COUNTRIES OF RECENT TECHNICAL ADVANCES IN THE PRODUCTION OF PULP AND PAPER

By Hans Wilhelm GIERTZ

Papers have been contributed to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas as working papers for that Conference. They are published as presented by the contributors, and the contents and the views expressed are those of the contributors. (See notes overleaf.)

NOTES

1. Papers selected for inclusion in General Sessions will be available at the Conference in the following official languages of the United Nations: English, French, Russian and Spanish.

2. Papers selected for inclusion in Specialized Sessions will be available at the Conference in only one of the above official languages.

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Implications for Developing Countries of Recent Technical Advances in the Production of Pulp and Paper

No. 002
D.5.1

Summary

1. Up to the second world war the predominant part of all paper and board in the world was produced from long fibre coniferous wood and the prevalent opinion was that paper products had to be made from long fibre pulps. The raw materials available in developing countries, however, are generally of the short fibre type, such as broadleaved woods, bagasse, straw and other agricultural residues, and this fact has been considered to be of greatest importance when planning for a new paper industry in these countries.

2. It is today an established fact that short fibre raw materials to a large extent can be used for paper and board production. For products like printing and writing papers, ordinary wrapping papers and corrugating board the main part of the furnish can consist of short fibre pulps, whereas for products with high strength requirements, as kraft papers and multi-wall sack papers, the long fibre portion must be about 50 per cent or more. With the new technique of making extensible papers it might be possible to reduce this portion.

3. In the field of pulping an important problem is to find a substitution for the kraft processes. The kraft process has the great advantage of being the single process according to which all kinds of raw materials can be pulped; at the same time, however, the kraft process requires an expensive installation for the recovery of the chemicals, making it necessary to build large units in order to achieve economical production. Great progress has in the last few years been made in developing new processes of sulphite cooking, which do not necessarily require a recovery system and therefore can be built in smaller units. The technical experience of such processes in the field of different types of broadleaved pulps and agricultural residues is still incomplete and meagre.

4. Important improvements have been made in using broadleaved wood in the production of mechanical pulp and newsprint. Today pine groundwood or a mixture of groundwood and semi-chemical pulp from certain hardwoods can substitute spruce groundwood in newsprint. The same holds for bagasse.

5. In the field of papermaking, recent developments and improvements are of limited implication for developing countries. It seems likely, however, that a recent innovation in the field of paper machine construction will be of importance, making it possible to produce on one and the same machine a great variety of products with widely different basis weight which includes the most common types of paper and board products.

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